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Sup. Ct

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1945

No. 46

GENERAL ELECTRIC COMPANY, PETITIONER,

vs.

JEWEL INCANDESCENT LAMP COMPANY, ET AL.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

PETITION FOR CERTIORARI FILED MARCH 20, 1945.

CERTIORARI GRANTED APRIL 9, 1945.

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DOCKET ENTRIES.

May 20, 1936. Bill of Complaint filed.

May 20, 1936. Subpœna issued.

May 27, 1936. Subpœna returned, served on May 26th, filed.

June 24, 1936. Answer filed.

June 29, 1936. Notice fixing place for Trial filed (Newark).

Jan. 11, 1937. Order Dropping case under Equity Rule 57, filed.

Jan. 10, 1938. Order Restoring Case to Trial Calendar, filed.

July 10, 1941. Order adjourning Trial to Sept. 11, 1941, filed.

Aug. 9, 1941. Plaintiff's Interrogatories to Defendants, filed.

Sept. 24, 1941. Trial without Jury. Adjourned to Sept. 25.

Sept. 25, 1941. Trial continued. Decision Reserved. (Smith).

Dec. 9, 1942. Findings of Fact & Conclusions of Law, filed.

Dec. 9, 1942. Memorandum filed (Smith). Judgment for Defendants to be entered.

Jan. 8, 1943. Final Judgment Dismissing Complaint with costs to Defendant, filed.

Jan. 8, 1943.	Judgment for Defendants against Plaintiff for Costs, entered. (Notice sent Attorneys).
Apr. 2, 1943.	Notice of Appeal filed (Copy sent C. C. A. & Darby & Darby).
Apr. 2, 1943.	Bond filed.
Apr. 30, 1943.	Order to withdraw Exhibits to prepare record on Appeal, filed.
Apr. 30, 1943.	Order to withdraw testimony for use in Appeal record and extend time to file Record to 6/21/43, filed.

[53]* **TESTIMONY.**

MR. NEAVE:

* * *

We have entered into some stipulations in this case which I would like to have the stenographer copy into the record.

[54] "It is stipulated and agreed by and between counsel for the respective parties in this case, but for the purposes of this case only, as follows:

"1. Printed or photographic copies of patents and publications may be offered in evidence and used with the same force and effect as certified copies, subject to correction if error shall appear, and the dates of filing appearing on patents and the dates and places of publication appearing on publications so offered may be taken as prima facie correct, but subject to correction;

"2. The incorporation of the plaintiff and the corporate defendants, and the plaintiff's title to the patent in suit, both as alleged in the bill of complaint, may be taken as proved;

"3. That Milton Brodbeck, if called as a witness on behalf of the plaintiff in this case, would testify as follows:

"I am Secretary of E. Brodbeck & Sons, Inc., a corporation doing business at 63 South Fourth [55] Avenue, Mount Vernon, New York.

"In about February 1936, I wrote to Jewel Incandescent Lamp Company, East Newark, New Jersey, ordering 120—25 Watt Frosted lamps. Within a short time thereafter I received a package which from the markings thereon evidently contained the 25 watt 'Jewel' lamps I had ordered from Jewel Incandescent Lamp Company.

*Figures in brackets are page numbers of Reporter's Typewritten Transcript of Testimony.

"This package was sent to me by a jobber, Ellis Davidson Company, Inc. Labels thereon bore the printed name of Jewel Incandescent Lamp Company, East Newark, New Jersey. A photostatic copy of the face of a carton showing said labels is attached hereto and it is marked 'Plaintiff's Exhibit 1—Jewel Carton.'

"About the same time that I received the package of lamps I received from Ellis Davidson Company, Inc., a bill for the lamps, allowing 35 per cent. discount. A photostatic copy of the bill is attached hereto and it is marked 'Plaintiff's Exhibit 2—Ellis Davidson Bill 2/28/36.' Upon receipt of this bill I wrote to Jewel Incandescent Lamp Company a letter, dated March 20, 1936, explaining that the discount to my Company should be 40 per cent. instead of 35 per cent., and ordering some 40 Watt inside frosted lamps and some 75 watt clear lamps, provided the 40 per cent. discount was allowed. A photostatic copy of my retained [56] copy of that letter is attached hereto and it is marked 'Plaintiff's Exhibit 3—Brodbeck letter.'

"In response to my letter I received from Jewel Incandescent Lamp Company, Incorporated, the letter of which a photostatic copy is attached hereto, marked 'Plaintiff's Exhibit 4—Jewel letter.'

"I then paid for the 25 watt lamps, taking the 40 per cent. discount, as agreed with Jewel Incandescent Lamp Company, Inc., and received from Ellis Davidson Company, Inc., a receipt therefor, dated April 16, 1936, on an invoice which is otherwise a duplicate of its bill of 2/28/36 (Plaintiff's Exhibit 2). A photostatic copy of that receipt is attached hereto and is marked 'Plaintiff's Exhibit 5—Receipt.'

"In further response to my letter to Jewel Incandescent Lamp Company I received by express from Jewel Incandescent Lamp Company two cartons which evidently contained respectively 40 watt frosted and 75

watt clear lamps which I had ordered in that letter. A photostatic copy of the markings on one of the cartons is attached hereto and it is marked 'Plaintiff's Exhibit 6—Carton.'

"About the same time I received from Ellis Davidson Company, Inc. an invoice dated March 28th, 1936, covering the lamps which I had ordered and received from Jewel Incandescent Lamp Company as stated above. [57] A photostatic copy of the invoice is attached hereto and it is marked 'Plaintiff's Exhibit 7—Invoice.' I then paid for those lamps.

"I did not open the three packages of lamps ordered and received by me as stated above, but turned them over unopened just as I had received them to Mr. Alfred L. Maul of the General Electric Company.

"4. That Alfred L. Maul, if called as a witness in behalf of the plaintiff in this case, would testify as follows:

"I received the above described three packages of lamps unopened from Mr. Milton Brodbeck, as testified by him. Each package contained thereon a label of Jewel Incandescendent Lamp Company. On opening these packages I found the lamps contained therein to bear the trademark 'Jewel' on the bulb and to be contained in individual wrappers bearing the name 'Jewel Incandescent Lamp Company,' as well as the trade-mark 'Jewel.' I thereafter shipped some of the above described 25 watt and 40 watt Jewel lamps to Charles D. Spencer of the Glass Technology Laboratory of the General Electric Company at Cleveland, Ohio. Each of the 25 watt lamps, before being shipped to Mr. Spencer was marked upon the brass base under my direction with the numerals '82' in black ink and each of the [58] 40 watt lamps was marked '82A' in the same manner.

"5. That for more than six years past prior to the filing of the bill of complaint in this cause the plaintiff, General Electric Company, manufactured and sold electric incandescent lamps with inside frosted bulbs, assertedly under the patent in suit, and it has been the practice of said plaintiff during that time to put all its said incandescent lamps in individual cartons or wrappers having printed thereon the numbers of several patents including, among others, patent No. 1,687,510, a typical example of such carton or wrapper being here produced as 'Plaintiff's Exhibit 8.'"

In connection with that stipulation there are certain exhibits I would like to offer; I would like to offer as Plaintiff's exhibit 1 a photostat of the labels on the Jewel carton. These exhibits are referred to by the same number in the stipulation.

(Received and marked Exhibit P-1.)

MR. NEAVE: As Plaintiff's Exhibit No. 2, a bill of Ellis G. Davidson Company, Inc., dated February 28, 1936, which I offer in evidence.

(Received and marked Exhibit P-2.)

MR. NEAVE: Plaintiff's Exhibit 3, letter from E. Brodbeck & Sons to Jewel Incandescendent Lamp Company, dated March 20, 1936.

[58-A] (Received in evidence and marked Exhibit P-3.)

MR. NEAVE: Plaintiff's Exhibit 4, Jewel Incandescent Lamp Company, letter to E. Brodbeck & Company, dated 3/28/36.

(Received and marked Exhibit P-4.)

MR. NEAVE: Plaintiff's Exhibit 5, receipt of Ellis Davidson Company, Inc., dated February 28, 1936.

[59] (Received and marked Exhibit P-5.)

MR. NEAVE: Plaintiff's Exhibit 6, photostat of certain labels on cartons from Jewel Incandescent Lamp Company.

(Received and marked Exhibit P-6.)

MR. NEAVE: Plaintiff's Exhibit 7, invoice of Ellis Davidson Company, Inc., dated March 28, 1936.

(Received and marked Exhibit P-7.)

MR. NEAVE: Plaintiff's Exhibit 8 is a sleeve of General Electric lamp in connection with a stipulation with regard to marking.

(Received and marked Exhibit P-8.)

MR. NEAVE: There is a second stipulation which I would like to have the stenographer copy into the record which pertains to the position of the individual defendants with relation to the Jewel Incandescent Lamp Company and the relationship of the Nulite Electric Company as a wholly owned subsidiary of Jewel. It is also stipulated in regard to the fact that both Jewel and Nulite sold lamps and that all questions in regard to accounting, profits and damages may be reserved for the accounting,

"It is hereby stipulated and agreed, by and between counsel for the respective parties, as follows:

[60] "1. Leonard Grossman is President of Jewel Incandescent Lamp Company and Gustave Herzberg is Secretary and Treasurer. Both are directors and have held their respective offices and directorships since their formation of that company. Mr. Grossman has charge of the office end of the company and Mr. Herzberg has charge of the manufacturing end.

"2. Nulite Electric Company is a wholly owned subsidiary of the Jewel Incandescent Lamp Company, has the same officers and directors as the latter company and has, within six years prior to the filing of the

bill of complaint, sold the inside frosted lamps manufactured by Jewel Incandescent Lamp Company.

"3. The lamps manufactured by defendant Jewel Incandescent Lamp Company and sold by defendant Nulite Electric Company consist of incandescent electric lamp bulbs with the interior surface frosted, and the interior surface of each and every such frosted bulb was frosted by etching.

"4. All questions relating to damages or profits, or to patent marking by plaintiff, or notice to defendants of their alleged infringement, may be reserved for the accounting, if any."

MR. NEAVE: I offer in evidence copy of Pipkin patent 1,687,510.

[61] (Received and marked Exhibit P-9.)

MR. NEAVE: I offer in evidence two volumes of the record of General Electric Company v. Save Sales Co.; this is being offered merely so that your Honor will be able to see what was before the Court at the time of the decision of that case.

(Received and marked Exhibits P-10 and P-10-A.)

MR. NEAVE: I offer in evidence volume of the record of General Electric v. Wabash Appliances Corporation, et al., in the Second Circuit Court of Appeals with the same limitation as to its use.

(Received and marked Exhibit P-11.)

CHARLES DOUGLAS SPENCER, called and sworn on behalf of the plaintiff, testified as follows:

DIRECT EXAMINATION.

By MR. NEAVE:

Q. 1. Mr. Spencer, what is your full name?

A. Charles Douglas Spencer.

Q. 2. And where do you reside?

A. At Cleveland, Ohio.

Q. 3. What is your position?

A. I am a physicist in the Glass Technological Laboratories of the Lamp Department of the General Electric Company.

Q. 4. Is that in Cleveland?

[62] A. That is in Cleveland, Ohio.

Q. 5. How long have you been so employed?

A. Since April of 1919.

Q. 6. What is your education and experience, Mr. Spencer?

A. I attended the University of Chicago and was in residence during the years '15, '16, '17 and '18, and during the latter part of '18 in the first World War I left Chicago to enter the Optics Section of the United States Bureau of Standards at Washington, D. C., and while there it was part of my duties to test optical systems, lenses and prisms and such things, mostly for military fire control instruments then, of course; and shortly after I went to the Bureau an optical glass factory was opened at Pittsburgh, the Pittsburgh division of the Bureau, and after a short stay at Washington I was transferred there in charge of the testing of optical glass.

Q. 7. From there did you go to the General Electric Company?

A. Yes, directly from the Pittsburgh Division of the Bureau in April of 1919 I went with the General Electric Company.

Q. 8. Have you had to do with the study of light diffusing glass bulbs for incandescent lamps while you have been with the General Electric Company?

A. Yes, I have.

Q. 9. That has been ever since you have started there?

[63] A. Yes, ever since May of 1919.

Q. 10. Now, why was that work undertaken by you at that time?

A. Well, then it was clearly recognized that some sort of a diffusing type of bulb was needed for an electric lamp;

practically all of the electric lamps that were then made were made with clear bulbs and it was recognized that they did cause glare and that it would be an advantage to diffuse the light of the filament, the very bright filament.

Q. 11. What were the requirements for a satisfactory diffusing electric lamp bulb?

A. Well, in the first place it should give satisfactory diffusion; of course it should give enough diffusion and it should not absorb too much light; it should not be too wasteful of light in getting the required amount of diffusion; the lamp should be st ng enough to withstand all of the hazards of manufacture and strong enough to withstand the use to which it is put after it is made and it should be cheap to manufacture.

Q. 12. I show you a photograph and ask you if you can identify it.

A. Yes. This is the photograph of ten lamps that are now and have been for a great many years in the Lighting Institute Museum of the General Electric Company at Nela Park.

[64] Q. 13. Will you describe each of these lamps and particularly with respect to the glass bulb?

A. Well, all of them represent attempts to obtain desired diffusion of the light. They are arranged roughly in order of their age, that is, No. 1 being probably the oldest lamp of the lot and No. 10 one of the more recent. In No. 1 we have what we call an iron mold bulb that is blown in a mold in which flutes or configurations are cut into the inside surface and it also looks as if the surface had been peened with a peening hammer.

Q. 14. That is the inside surface of the mold?

A. Of the mold, sir, to obtain a fluted and roughened surface on the exterior of the bulb.

Q. 15. What was the purpose of that?

A. To diffuse the light from the filament; and that is a carbon lamp, by the way—all of these are carbon lamps until No. 9.

Q. 16. What is the glass bulb No. 2?

A. No. 2 is an outside frosted bulb; the surface is frosted all over by means of etching, again to obtain desired diffusion.

Q. 17. Can you tell us what is meant by frosting and how it is achieved?

A. Well, frosting can be of two kinds; you can frost a bulb by sand blast or you can frost it by chemical [65] treatment, etching as we say. It is obvious how it is obtained in sand blast; little particles just impinge against the surface of the glass and cause little pieces about like the shape of an oyster shell to be removed from the surface. In chemical etching the glass is treated with a mixture so that during the interaction between the glass and the etching medium, crystals of silico-fluoride are formed. These are formed in contact with the surface, and as every chemical etching solution has the property of dissolving glass at the same time crystallizing the silico-fluorides, the presence of these crystals upon the surface acts as a protection to the glass directly under them and as the glass is dissolved beyond them and as they grow, little pyramidal shaped areas appear upon the surface.

Q. 18. Is a condition reached in the etching of glass by means of the acid where these crystals completely cover the surface of the glass?

A. Yes, they do. And when they do and if they do remain in position, then further etching ceases.

Q. 19. What is the character of the surface of these etched crevices?

A. The crevices that form between the pyramids, the pyramids being the projections on the surface, the crevices that form are sharp and angular.

Q. 20. With respect to lamps 3, 4, 5, 6 and 7, are [66] these also lamps having bulbs which have been molded such as you describe in No. 1?

A. Yes, they are.

Q. 21. I see that No. 7 has a rather different configuration. Has that got smaller markings on it than the others?

A. Yes, it has smaller, some of them. No, 1 would be about the same size and the surface of the mold is simply gone over with something like a peening hammer in wh ch there are indentations raised and depressed areas and the glass is blown in contact with that surface.

Q. 22. Can you tell me what objection there was, if any, to these lamps having molded glass bulbs?

A. Well, in the first place, a molded glass bulb is not cheap to produce. Molds of the character for instance of No. 1, 3, 4 and 6 are rather costly to make. They have to be all cut out in the mold and in blowing them, particularly in blowing them in quantity, you would run into what we would call difficulties of poor distribution; there are thickened areas and thin areas and that is also a factor in lamp production.

Q. 23. Is the lamp No. 8 also an outside frosted bulb?

A. Lamp No. 8 is an outside frosted bulb.

Q. 24. Now, what objection, if any, was there, to the outside frosted lamp?

[67] A. Well, an outside frosted lamp, either frosted by sand blast or frosted by chemical etching, has a roughened surface, easily becomes contaminated with dirt and grease and it is almost impossible to clean it up and make it look like it was when it was brand new; and even then the dirt that works down into the fine crevices causes an absorption of light.

Q. 25. Referring to the lamp No. 9 will you tell us what that is?

A. Lamp No. 9 was known as the white Mazda. It is a lamp made with an opal type of glass diffusing bulb. It is a fluoride opal glass.

Q. 26. That is the glass itself is cloudy?

A. The glass itself is cloudy just like milk is cloudy and for the same reason.

Q. 27. Was that a satisfactory diffusing lamp?

A. No, it is not a satisfactory diffusing lamp although the diffusion is very great. One particular difficulty is in trying to make that particular type of a lamp uniform; you see, if you have your diffusing material contained within the walls of the bulb, the thickness of the glass, then slight variations in thickness or major variations in thickness cause the lamp to appear mottled and for that reason, and also for the reason too that the absorption is very high, you may like to maintain, say, [68] your absorption at a low figure; but these inevitable variations in wall thickness cause the absorption to rapidly increase.

Q. 28. What is lamp No. 10?

A. Lamp No. 10 is an outside coated lamp, again an attempt to make a diffusing bulb by putting on the outside a coating which will diffuse the light.

Q. 29. What objection was there, if any, to that particular lamp?

A. That lamp also gets dirty; its surface is not smooth like your clear glass bulb and its absorption is fairly high.

MR. NEAVE: I offer in evidence photograph of the ten lamps concerning which Mr. Spencer has been testifying.

MR. DARBY: No objection.

(Received and marked Exhibit P-12.)

Q. 30. Mr. Spencer, I show you what appear to be photostats of five advertisements in the "Electrical World" and "Saturday Evening Post," which refer to a certain type of lamp. Can you identify what type of lamp, that is with respect to the lamps shown on the photograph, Plaintiff's Exhibit 12?

A. Yes. In each instance the lamp there described is the white Mazda, illustration No. 9 in the photograph.

[69] MR. NEAVE: I offer in evidence the photostat of advertisements as one exhibit.

MR. DARBY: I object to that as wholly irrelevant and immaterial, advertisements about some lamps that admittedly have nothing to do with this case.

MR. NEAVE: Your Honor, the point I am making here is that this lamp was put on the market in 1919 and 1920 as one of the attempts to get a satisfactory diffusing lamp; it was advertised and given a good show.

MR. DARBY: I submit, if the Court please, that this exhibit does not even tend in that direction. All this exhibit shows is that lamps of that kind were put on the market and the witness or somebody having knowledge of it can so testify if that fact is relevant and material. But these exhibits are certainly irrelevant and immaterial and incompetent for the intended purpose.

THE COURT: I suppose his next step in his proof will be evidence that despite the extent of the advertising and the real effort to merchandise the product it was to a degree commercially unsuccessful.

MR. DARBY: If that is Mr. Neave's next step I think your Honor will be just as surprised as I am.

THE COURT: I don't know. I cannot see any other reason for it.

[70] Suppose you tell me.

MR. NEAVE: Well, I am going to ask the witness next as to what was the type of lamp that was most commonly sold during the early years for a diffusing lamp.

MR. DARBY: That shows the danger of speculation.

THE COURT: I am afraid it will not serve any purpose.

MR. NEAVE: My purpose in offering this exhibit, your Honor, is to show that there were lamps that were

offered to the public which were offered as diffusing lamps. It is bolstering Mr. Spencer's testimony that there was a need for a diffusing lamp. Now we put this on the market in 1919; we advertised it as a reducer of glare; we told the public that here was a lamp which they could use to reduce glare.

THE COURT: I will allow it rather than spend a half hour arguing about it. I don't think it will prejudice your case, Mr. Darby.

MR. DARBY: I don't think so either, but I would like to keep my record within reasonable limits.

(Received and marked Exhibit P-13.)

Q. 31. Mr. Spencer, which of these ten lamps shown in Plaintiff's Exhibit No. 12 was the one that was the most popular prior to 1925 as a diffusing lamp bulb?

[71] A. The outside frosted type, like 2 and 8.

Q. 32. And what was the objection to the outside frosted lamp, if any——

A. Well——

THE COURT: He has stated it; why state it again?

Q. 33. You stated that the lamp got dirty.

A. Yes.

Q. 34. And the effect of the lamp getting dirty was what?

A. The loss of light.

Q. 35. Mr. Spencer, this loss of light from outside frosted lamps was that one of the problems you worked on when you first came to the General Electric Company?

A. Well, in May 1919 one of the problems assigned to me was the production and the study of a diffusing type of bulb for lamps, yes.

Q. 36. What did you try to do to solve the problem of a satisfactory diffusing type of bulb for lamps?

A. I tried numerous things; the production of exactly the same type——

MR. DARBY: Your Honor, I hate to interrupt, but still I am forced to object as irrelevant and immaterial. I don't see how what this man did has the slightest bearing on the validity or infringement of the Pipkin patent.

MR. NEAVE: Well, may it please the Court, I [72] think here we are placing the background and the problem in the art; what took place prior to the Pipkin invention is of importance as showing what the problem was. In fact, Mr. Darby's statement in his opening shows that clearly.

THE COURT: Well, of course, the difficulty counselor, is, I suppose, Mr. Darby concedes that the ordinary bulb with the filament completely exposed, with the resultant glare was not satisfactory and that there was in the industry some effort to overcome this objectionable feature. You concede that, I suppose.

MR. DARBY: If such a concession is necessary.

THE COURT: I mean all this proof is directed toward answering the one question: Was there even a problem for the exercise of inventive genius for its solution? Is that right, Mr. Neave?

MR. NEAVE: That is correct, exactly, sir.

MR. DARBY: But if that is what Mr. Neave is seeking to prove, I submit that this testimony is not in that direction. Here is a man who comes from the General Electric Company; he is asked what he did when he came to the General Electric Company. That does not prove the existence of the problem nor does it prove any attempt to solve the problem.

[73] MR. NEAVE: If you will permit him to testify you will see how it works out.

MR. DARBY: I certainly will permit him to testify if you ask him proper questions unless the Court makes me sit down.

THE COURT: Oh, no, you may stand or sit, whichever way you are comfortable.

MR. NEAVE: Your Honor, I think perhaps the next question will bring out the trend of the examination.

THE COURT: I will allow him to answer the question.

(The reporter reads as follows):

"I tried numerous things. The production of exactly the same type"——

A. (Continuing.) —the same type of frosting by chemical means on the inside surface of a lamp bulb by means of identically the same solution used for frosting the outside resulted in a bulb that was excessively weak and I did that and I looked at it under the microscope to see if I could find a difference in the physical structure or appearance of the glass on the outside of the bulb and on the inside of the bulb, because the outside frosted bulb was strong, and I found no such difference.

Q. 37. When you came with the General Electric Company in 1919 was there on the market at that time, as far as [74] you know, an inside frosted lamp?

A. There was not.

Q. 38. Now, why did you not proceed with the making up of lamps from the inside frosted bulbs which you made at that time.

MR. DARBY: I object to that as irrelevant and immaterial and incompetent unless it is confined to the witness' own interest.

MR. NEAVE: I asked him——

THE WITNESS: Yes, I did that.

MR. DARBY: It is absolutely irrelevant and immaterial. What difference does it make what he did or why he didn't do it?

(Question repeated by the reporter.)

THE COURT: I will let him answer it.

A. Bulbs were so weak that they would break in manufacture right on the machines; when they hit the supports which are metal and are placed in the machine, they will crack.

Q. 39. Have you made a study of a large number of outside and inside frosted bulbs, examined the surface of those bulbs?

A. Yes, many, many hundreds.

Q. 40. Have you made that study under the microscope?

A. Yes.

Q. 41. And have you made photo micrographs of any such [75] surfaces?

A. Many, many hundreds.

Q. 42. I want to now consider the character of the inside and outside frosted surfaces. I show you a plaster cast and ask you whether you can identify this.

A. Yes, this is a plaster cast made from a wax model that I prepared in 1926 and it illustrates the type of surfaces that you obtain on a piece of glass when you frost it by chemical means.

Q. 43. Whether on the outside or the inside?

A. Outside or inside, yes.

Q. 44. Will you please explain what the surface shows?

A. The magnification of this model is about 3,000 times. These areas that you see here roughly pyramidal in shape are the protuberances or projections which are formed on the surface during the frosting. These are the peaks and the valleys that are formed between them. Remember that during chemical frosting, at these points that I have marked here with XX, crystals of silico-fluoride, the product of reaction between the frosting mixture and the glass, start to grow, but at the same time that they are growing in contact with the glass surface, the frosting medium is dissolv-

ing the glass not covered by the crystal so that in the end what we have is a type of surface that you see illustrated here. That is nothing but glass, [76] understand, this does not represent crystals now, because this represents the surface of the glass after the etching has taken place and then all of the reaction products have been removed.

Q. 45. Does the thickness of that model represent the thickness of a glass bulb?

A. Oh, no, because at 3,000 times magnification, an ordinary lamp bulb with one-half mm. wall thickness at maximum diameter, would be about a meter and a half thick.

THE COURT: The reaction product is removed almost as rapidly as it is formed, isn't that true, by the solution itself?

THE WITNESS: No, your Honor. Maybe I can make that clear. If this represents the original surface of the glass and we are treating it with a frosting mixture, at certain points crystals of silico-fluoride start to form; and suppose we represent a point here by X and X; now, the crystal grows in area and the liquid dissolves the glass so that the first increment in area of this crystal would be represented by these and then the glass level would be lowered to here. Now, each little increment in area of this crystal as it grows is again at a lower level and again the glass level is lowered to here. So what you have when the whole surface [77] is covered with silico-fluoride crystal is this sort of a cap crystal of silico-fluoride which has grown on this mound or projection on the surface of the glass, and of course after that is washed that is removed and this represents nothing but glass.

Q. 46. Mr. Spencer, is the crystal dissolved, the silico-fluoride crystal dissolved in acid etching solution?

A. No.

Q. 47. Does it stay until washed with something that will dissolve those crystals to get them off the glass?

A. Yes, except they may come away in a few places due maybe to gravity which will pull them away.

Q. 48. And is that the reason why after treating with a frosting solution for a certain length of time there is no further frosting action because the silico-fluoride crystals themselves do not dissolve in the acid solution?

A. The silico-fluoride crystals which form as the reaction product between the frosting medium and the glass are insoluble in the frosting medium.

MR. NEAVE: Does that answer your question?

THE COURT: I know that. That is always true. The crystal is never soluble in that which produces it or you would never have had a crystal. The reaction takes place. You misunderstood it, but I understand it anyway. It does not make any [78] difference; there is the chemical reaction that occurs first and then the deposit of a crystal on the surface, the reaction occurring between the silica of the glass and the hydrofluoric acid.

THE WITNESS: That's right, your Honor.

THE COURT: Then the deposit of crystal, which subsequently must be removed by washing?

THE WITNESS: Exactly. It is not as though you placed that on top of the surface; it grows in intimate contact with it.

THE COURT: Crystallization is a growth. I don't mean that someone comes in and lays it on; they grow.

THE WITNESS: That's right.

Q. 49. And that is the reason you get these pyramidal projections?

A. Yes. Most of these crystals formed are ammonium silico-fluoride because the solution is usually high in ammonia.

MR. NEAVE: I would like to offer this in evidence.

(Received and marked Exhibit P-14.)

Q. 50. If a bulb has on its outside surface a surface of that character shown in Plaintiff's Exhibit 14, what will be the strength of the bulb, that is, will its strength [79] be affected as compared with a clear bulb?

A. No, it will not. It is practically the same strength as a clear bulb.

Q. 51. Now, if that surface is on the inside of a bulb, how will it affect the strength of the bulb as compared with the clear bulb?

A. As compared with the clear bulb it is very materially weakened, very fragile indeed.

Q. 52. I show you a second plaster cast and ask you if you can identify it.

A. Yes, this again is a plaster cast from a wax model that I constructed in 1926 and here again I have tried to illustrate exactly the same surface as present as formed in this exhibit No. 14. But in this instance, the crevices surrounding the pyramidal projections have been rounded out.

MR. NEAVE: Let me have that cast, please.

I offer this in evidence.

MR. DARBY: No objection.

(Received and marked Plaintiff's Exhibit 15.)

Q. 53. Now, Mr. Spencer, if the inside surface of a bulb were of the character shown in Plaintiff's Exhibit 15, how would the strength of that bulb compare with the strength of a clear bulb?

A. Well, in this case a bulb with this type of surface on its inside is practically as strong as the clear bulb [80] itself.

Q. 54. And therefore very much stronger than a bulb with an interior surface such as shown in Plaintiff's Exhibit 14?

A. Oh, yes, many, many times; expressed in per cent. maybe a thousand times or more.

Q. 55. What is the explanation of the reason for that?

A. Because in the instance where we have sharp angular crevices on the inside surface and the bulb is subjected to impact on its outer surface, the inner surface tends to be extended and therefore it is put into tension and the sharp angular crevices are the starting point for cracks, whereas in the case of Exhibit No. 15 where the crevice has been rounded out the impact against a bulb having on its inner surface this type of frosting, is such that the testing effort is spread over a very much larger area and the bulb is almost as strong as it was before frosting.

Q. 56. I show you a book of photomicrographs containing three pages and ask you if you can identify these photomicrographs. In the first place, did you make them?

A. Yes, I did.

Q. 57. And from what surfaces were they made?

A. Well, in the case on page 1 this is a photomicrograph—there are two photomicrographs, one marked "Illumination Transmitted," and the other "Illumination Reflected"; they are photomicrographs of the same specimen of glass [81] of a specimen from a G. E. inside frosted bulb.

Q. 58. Is that a General Electric lamp such as one can purchase in the market?

A. That is a General Electric lamp, yes.

Q. 59. It was from your ordinary commercial production?

A. Yes.

Q. 60. Now, I note at the top of the page the legend reads "G. E. Inside Frosted bulb Surface, zone A." What does zone A mean?

A. I divided the bulb into three zones, the first zone centering at the top of the bulb which includes the monogram. Zone B is a zone then centering at maximum diameter and Zone C is from the neck of the bulb.

Q. 61. Do I understand that all of the pictures in this book were taken from the same bulb?

A. They are from the same lamp bulb, yes.

Q. 62. And page 1 shows pictures from Zone A?

A. Zone A.

Q. 63. Page 2 from Zone B?

A. Zone B.

Q. 64. And page 3 from Zone C?

A. That is right.

[82] Q. 65. Turning back to page 1 again, under Zone A, I find XX. What does that refer to?

A. That is the marking given the bulb to designate it.

Q. 66. Given the bulb or the fragment?

A. In this case the fragments.

Q. 67. And on page 2 I find it is XXI.

A. Yes.

Q. 68. And on page 3 it is XXII.

A. XXII.

Q. 69. So that these were three different fragments from the same bulb?

A. Three different fragments from the same bulb, from Zones A, B, and C.

Q. 70. That's right. Now, turning again to page 1, I see that there are two photomicrographs on this page. Will you please explain why there are two and what the difference is between them?

A. Well, as you will note the first one is marked "Illumination Transmitted," and the second, "Illumination Reflected."

Q. 71. They are both pictures of the same fragment?

A. That is the same fragment.

Q. 72. The same place?

A. The same place. And if you compare the center ones, I think you can see there the characteristic areas. You can identify them. In the first case, the light is transmitted through the specimen. That is, the specimen is put upon the stage of the microscope the frosted surface [83] uppermost, and the light is transmitted through that surface towards the objective. In the case of the second one, marked "Illumination Reflected," in this instance the light originates above the specimen and is then transmitted down to the surface, and the photomicrograph is made in reflected light.

Q. 73. What are the dark portions on each side of the photograph?

A. Well, at each end there are dark areas which are shadows of droplets of resin that were placed upon the surface, so that we can identify exactly the same area.

Q. 74. Now, will you please take the photomicrograph shown at the top of page 1 and explain what it shows with respect to the elevations and crevices, referring, if you wish, to either of the models, in explaining just what this photomicrograph discloses?

A. Well, in the case of the illumination transmitted, Zone A, of fragment marked XX, in the center photomicrograph here of the three, you will note these light appearing areas surrounded by darker appearing areas. These light appearing areas represent the projections, the remnants of these pyramids that I have pointed ont in the——

THE COURT: In Model 14?

Q. 75. In Model 15?

A. In Model 15, sir.

[84] And here near the center of the Zone A XX fragment, there are two areas which correspond to these projections that I have pointed out in this wax model, plaster model. The darkened areas surrounding these are the depressions; and they appear in that manner because of the way in which the light is transmitted through the surface.

Q. 76. I don't understand that that plaster model, Plaintiff's Exhibit 15, is a representation of any specific surface shown in these pictures.

A. Oh, no, no.

THE COURT: They are only illustrative.

THE WITNESS: That's right.

MR. NEAVE: I just wanted to make sure that your Honor understood that.

Q. 77. Now, what would you say was the character of the surface of the lamp shown in these photomicrographs?

A. Well, the character of the surface is that of raised projections surrounded by these rounded out crevices.

Q. 78. Would you say that that was characteristic of the entire General Electric lamp that you examined to make these photographs?

A. Yes, it is.

Q. 79. And is that characteristic of the General Electric lamps as sold, inside frosted lamps as sold, since 1925?

A. It is.

[85] MR. NEAVE: I offer in evidence the book of microphotographs of General Electric inside frosted surface, just referred to by the witness, as Plaintiff's Exhibit 16.

THE CLERK: P-16.

Q. 80. Approximately how many General Electric inside frosted lamps have been sold since 1925 which have a surface of the character shown in these photomicrographs, Plaintiff's Exhibit P-16?

A. Oh, from 1925 through 1940 about 2,636,000,000 lamps.

Q. 81. Will you please describe for us briefly how these inside frosted lamps are frosted by the General Electric Company?

A. Yes. They are frosted on a machine and the bulbs are placed in trays containing 100 bulbs. These are moved by means of a pneumatic device, so as to pass over a series of jets or nozzles which communicate with tanks underneath them. The frosting medium is sprayed into the bulb. It is then moved on to the next position. It is then treated with the other medium, the fortifying medium, a weaker acid, which is sprayed into them. It goes on successively through washing positions and then through a tunnel drier which dries the bulbs.

MR. NEAVE: Your Honor, I would like to have the witness explain this bump tester which you see [86] on your left, and break some of these bulbs. I think if we

can do it before the luncheon hour the mess can be cleared off during lunch.

THE COURT: All right.

Q. 82. Mr. Spencer, will you please explain the bump tester which is on the table near your witness chair? In the first place, is this bump tester of similar construction to that shown in Fig. 6 of the Pipkin patent?

A. Yes, it is. And it is a very simple device, designed to test the strength of the lamp bulb. An ivory ball swings like a pendulum from a support and can be moved through a semi-circle. There are graduations on the scale, starting out at 1, 2, 3, up to 20, and these graduations represent an increase in height of the center of that ivory ball in steps of ¼th of an inch. From there on, from 20 to the top of the scale, the graduations are—they go from 20 to 22, to 24. That is, in graduations representing a half an inch increase in the height. The bulb is placed in a holder and so arranged that the ivory ball can impinge against its surface.

Q. 83. Will you please take a clear bulb and place it in the bump tester and give it a bump test? I think in order to save time you might go up by 5's in the graduation.

A. I place the bulb in the holder and raise the ball to 5; [87] 5; 10; 20; 30; 40; 50 [demonstrating].

Q. 84. At what point did the clear glass bulb break?

A. The clear glass bulb broke at 50.

Q. 85. Now will you please place in the bump tester an inside frosted bulb, which you have prepared, I understand? This inside frosted bulb, am I correct, has been prepared with a frosting solution similar to that used prior to the Pipkin patent?

A. Yes.

Q. 86. Will you please place it in the machine and bump tester?

MR. DARBY: Now, here is where I have got to object, your Honor. As I understand it, here it becomes a matter of importance to know just how that bulb was

made. I understand that this is supposed to illustrate how weak a bulb is.

MR. NEAVE: That's correct.

MR. DARBY: That has just been frosted once. Well, now, you can make anything that will break, if you look at it, or can make it strong enough, if you want to. And I object to this as irrelevant and immaterial unless it is proven conclusively just precisely how that lamp was made, how that bulb was made.

Q. 87. Well, Mr. Spencer, will you tell us how this was frosted?

[88] A. Well, this bulb was frosted on the Standard General Electric machine and removed from the first position.

Q. 88. That is, it was removed before it was given the fortifying, so-called fortifying treatment?

A. That is right.

By MR. DARBY:

XQ. 89. What was the frosting solution, and its concentration, and the length of treatment?

MR. NEAVE: All right, Mr. Spencer, will you tell us——

THE WITNESS: Yes, sir.

MR. NEAVE: —what the frosting solution was, if you can remember it, and what its concentration was, and what the length of treatment was?

THE WITNESS: Yes, I can answer your question, Mr. Neave.

MR. NEAVE: If that is not a trade secret of the General Electric Company.

MR. DARBY: I suppose it is.

THE WITNESS: Well, I can tell you it is the regular frosting solution that we have used. It contains ammo-

nium bifluoride, hydrofluoric acid, and ammonium carbonate.

XQ. Do you know the proportions?

A. Roughly?

[89] XQ. 91. Yes.

A. You want them roughly, sir?

XQ. 92. Yes.

A. About, say, 25 per cent. free HF. Sodium maybe 5; and ammonia probably about 12.

XQ. 93. And concentration?

A. Of the what?

XQ. 94. Of the HF.

A. Of the HF?

XQ. 95. Yes.

A. About 25 per cent.

XQ. 96. About 25 per cent. And the temperature?

A. 140 degrees Fahrenheit.

XQ. 97. And how long was the etching solution allowed to remain in the bulb?

A. A bulb of this size is usually frosted with about three shots; so 1, 2, 3, 4,—something like 5 seconds.

MR. NEAVE: Five seconds for each shot, or all together?

THE WITNESS: No, all the shots at one treatment.

XQ. 98. That's just one etching step? I mean that's just one etching treatment?

THE COURT: He said it was put over the jet and given five seconds.

THE WITNESS: Yes, put over the jet and given [90] five seconds.

MR. NEAVE: It is the same frosting solution; each of the shots was from the same frosting solution?

THE WITNESS: That's correct, yes.

XQ. 99. And all within the period of about five seconds?

A. Yes.

XQ. 100. And is that the identical solution and the identical treatment that was used in your commercial run at that time?

A. That we use now? Yes.

MR. NEAVE: At the time that you made the bulb.

XQ. 101. At the time that you made the bulb?

A. Yes, yes.

By MR. NEAVE:

Q. 102. Do I understand that you took that bulb out of the commercial line?

A. I did.

Q. 103. After it had been frosted?

A. Yes.

Q. 104. And before it had been given any other treatment?

A. Yes.

MR. DARBY: Just two more questions, if I may ask them?

MR. NEAVE: Yes, that's all right.

By MR. DARBY:

[91] XQ. 105. Was the lamp subjected to any washing?

A. This bulb? Yes, it has been washed.

XQ. 106. With what?

A. With water.

XQ. 107. Hot or cold?

A. With hot water, to remove the products.

XQ. 108. And what was the temperature of the water?

A. Probably 50 or so; just about so you could put your hand in it.

MR. NEAVE: Is this Centigrade?

THE WITNESS: Centigrade.

XQ. 109. And, one more thing: What time elapsed between the etching and the washing?

A. Again a matter of maybe five seconds.

By MR. NEAVE:

Q. 110. That is, you just took it off the line and you washed it?

A. That's right.

By MR. DARBY:

XQ. 111. And it received no subsequent washing treatment?

A. No.

MR. DARBY: All right, I will withdraw my objection, go ahead.

By MR. NEAVE:

Q. 112. Go ahead, Mr. Spencer.

[92] A. I place this bulb in the holder— –

Q. 113. At what height are you holding the ball?

A. At 5; and it breaks. (Operating machine.)

Q. 114. The bulb broke at 5?

A. The bulb broke at 5.

Q. 115. Will you now please put in the bump tester an inside frosted bulb, which you took from the General Electric commercial production line, after the bulb had been given its full treatment?

A. Yes, I have such a bulb. I will place it in the holder.

Q. 116. Now, is that treatment the treatment which you have described before you started your bump testing?

A. Pardon?

Q. 116a. Is that treatment the treatment that you described before you started the bump testing?

A. For the regular production, yes.

Q. 116b. That's right. All right, go ahead.

A. I hold it at 5; 10; 20; 30; 40; 50 (operating machine).

Q. 116c. At what point did the bulb break?
A. The bulb broke at 50, bump tester.

MR. NEAVE: All right. Thank you.
Shall we stop now, your Honor?

THE COURT: Yes, I think it would be a good time. We will recess until two o'clock.

NOON RECESS.

AFTERNOON SESSION.

[93] CHARLES DOUGLASS SPENCER, resumed the stand.

DIRECT EXAMINATION (Continued).

BY MR. NEAVE:

Q. 117. Mr. Spencer, has it been one of your duties with the General Electric Company to make tests upon lamps and bulbs for strength and also to make tests on lamps for maximum brightness?

A. It has.

Q. 118. It has been stipulated in this case that Mr. Maul, of the General Electric Company, sent you certain lamps which were marked on their base 82 and 82A. Did you receive such lamps?

A. Yes, I did.

Q. 119. I show you two lamps and ask you whether they are among the lamps which you received?

THE COURT: Well, here is 82.

A. Yes, sir, those are——

MR. NEAVE: Yes. I just used that for exhibition purposes. I want to offer these two in evidence.

A. (Continuing) Yes, they were among the lot that I received.

MR. NEAVE: I offer in evidence a lamp in a sleeve bearing the name Jewel, base mark 82, as Plaintiff's Exhibit 17.

THE CLERK: P-17.

[94] MR. NEAVE: And a lamp marked 82A on its base in a sleeve bearing the name Jewel as Plaintiff's Exhibit 18.

THE CLERK: P-18.

Q. 120. Mr. Spencer, when you received certain lamps marked 82 and 82A, did you mark on the base of some of these lamps certain other numbers? And if you did, what were those numbers?

A. Yes, I did. I numbered them as I used them, consecutively, 1, 2, 3, and so forth.

Q. 121. Have you tested the Jewel lamps 82 and 82A for strength and maximum brightness?

A. Yes, I have.

Q. 122. Will you tell us what markings were on the lamps which you tested, in addition to the figures 82 and 82A?

A. The lamps marked 82 in black ink on the brass base were monogramed on the top of the bulb "Jewel," the word "Jewel" surrounded by a circle, and in that circle 25W, 120V; and those marked 82A on the brass base had on the top of the bulb the same type of monogram but marked 40 Watt, 40W, 120V.

Q. 123. What is meant by maximum brightness?

A. Well, maximum brightness means the brightest thing that you see in your line of vision. In looking at a clear bulb, it is the projected image of the filament [95] itself as seen through the clear glass. In the case of an inside frosted bulb, it is the brighest part of the lamp that you can see, which in this instance is a portion of the frosted surface.

Q. 124. Is maximum brightness a measure of the amount of light given out by the bulb?

A. Oh, no; no, it has nothing to do with the amount of light; only with the relative intensity or brightness.

Q. 125. That is, it may be called a measure of glare?

A. It may be called a measure of glare in that it does measure brightness.

Q. 126. How many of these Jewel lamps, 82 and 82A, did you test for strength and maximum brightness?

A. I tested 10 of each lot; that is, 10 of 82 and 10 of 82A; first for maximum brightness, and then bump tested those identical lamps for strength.

Q. 127. And were those lamps marked 1 to 10, consecutively?

A. Those were marked by me 1 to 10, consecutively.

Q. 128. Both in the 82 and in the 82A series?

A. That is right.

Q. 129. After you had made the bump tests and the maximum brightness tests, did you make any tests of the maximum brightness of Jewel lamps in clear bulbs?

A. Yes, I did.

[96] Q. 130. How did you do this?

A. By removing the mount from the inside frosted Jewel lamp and mounting them in clear bulbs.

MR. NEAVE: This was done, your Honor, because we had no corresponding clear bulb Jewel lamps. We couldn't get any.

THE COURT: They were out of production, all the new ones, the new results?

MR. NEAVE: No, in these particular wattages there weren't any at that time.

Q. 131. Now, Mr. Spencer, have you made up a table of the results of these tests?

A. Yes, I have; and here is such a table.

THE COURT: Well, Mr. Neave, it isn't your contention, is it, that the mere manufacture of a bulb as strong as yours with a brightness equal to that of yours is an infringement?

MR. NEAVE: No, sir.

THE COURT: All right.

MR. NEAVE: No. This is just one step in the line. We have got certain requirements in the claims——

THE COURT: I just wondered. I wondered particularly after having read the General Electric v. Save, whether or not there was any such contention, because I am afraid that in his decision Judge Simon [97] was misled as to a fact.

MR. NEAVE: No, we are making no such contention, your Honor.

THE COURT: I don't mean wilfully misled, but it appears that either he understands the principle and I misunderstand it, or he misunderstood it and I understand it. Now I don't know which.

MR. NEAVE: Well, I think your Honor understands it; that the claims, as I have pointed out, have these three characteristics; one of strength, one of diffusion, and one of structure.

THE COURT: Yes, but he seemed to have had the idea that strength was imparted by the deposit of crystal in the crevice.

MR. NEAVE: Well, I think——

THE COURT: Which isn't so.

MR. NEAVE: I think that's not correct. He must have been misled on that.

THE COURT: Well, his opinion so reads, as though the second washing and deposited crystalline substance, or some substance in the crevice, strengthened it; and that couldn't possibly be true.

MR. NEAVE: I think Mr. Spencer's testimony this morning made that clear, your Honor.

THE COURT: Well, I mean I am just wondering [98] what happened to him, that's all; or maybe I was mistaken. All right, go ahead.

By MR. NEAVE:

Q. 132. Mr. Spencer, you have handed me a sheet on which appears certain strength bump tests and maximum brightness tests of Jewel lamps; is that correct?

A. That is right, sir.

MR. NEAVE: To save time, I would like to have that copied in the record rather than offered as an exhibit.

(The tabulation referred to follows:)

Strength and Brightness of Jewel Lamps

	Number of Lamp	Strength (Bump Test)	Maximum Brightness Frosted Lamp
25-Watt	82-1	26	3.1
	82-2*	34	3.3
	82-3	40	2.2
	82-4	38	3.2
	82-5	28	3.5
	82-6*	34	3.4
	82-7	19	3.3
	82-8	19	3.6
	82-9	46	3.3
	82-10	40	2.9
	Average Strength	32.4	
		Average	3.2

Average maximum brightness of ten 25 Watt Jewel lamps reconstructed with clear bulbs into lamps: 194.

*Indicates the two lamps having strength closest to average.

[99] 40 Watt	82A-1	16	6.7
	82A-2	24	5.6
	82A-3	18	6.0
	82A-4*	24	5.5
	82A-5	36	5.5
	82A-6	40	5.6
	82A-7	36	5.1
	82A-8	36	5.7
	82A-9	36	4.3
	82A-10*	30	4.4
	Average Strength	29.6	
			Average 5.4

Average Maximum brightness of ten 40 Watt Jewel lamps reconstructed with clear bulbs into lamps: 366.9.

*Indicates the two lamps having strength closest to average.

Q. 133. As a result of these tests will you state whether or not you found that the maximum brightness of each of the Jewel inside frosted lamps tested by you was considerably less than 25 percent of that of the clear bulb?

A. It is, considerably less, yes.

Q. 134. Now, I notice on this list that certain lamps, such as 82-2, 82-6, 82A-4 and 82A-10 have an asterisk after them. What does that represent?

A. That represents the lamps that I chose, two lamps that I chose as average lamps from those lots.

Q. 135. Have you made similar strength and brightness tests of 25 and 40 watt General Electric clear and inside frosted lamps of the same size of bulb and wattage and the same glass composition?

A. Yes, I have, and here is the table.

[100] Mr. Neave: I ask that the reporter copy this in as part of Mr. Spencer's testimony.

You have no objection, Mr. Darby, have you?

MR. DARBY: No.

Average Maximum Brightness and Strength of General Electric Lamps

	Clear	Frosted	Per cent
Average 25 Watt Maximum Brightness	287	4.9	1.7
Average 40 Watt Maximum Brightness	532	8.7	1.6
Average 25 Watt Strength (Bump Test)	52	46	88.5
Average 40 Watt Strength (Bump Test)	47	47	100.

Q. 136. Did you save all of the lamps, the Jewel lamps upon which you made these tests, the glass portions and the carcasses, so-called?

A. Yes, they were saved, and separately segregated.

MR. NEAVE: Now, these carcasses are available to defendant, if they want them, your Honor. I am not going to offer them in evidence, because they are rather bulky.

Q. 137. Did you examine the interior surface of the glass bulbs of each of the Jewel lamps which you thus tested?

A. Yes, I did.

Q. 138. Can you tell me the character of that surface? [101] A. The character of that surface on the inside of the bulb is that of elevations surrounded by depressions with rounded bottoms.

Q. 139. What was the nature of the examination that you made of those surfaces?

A. Well, in the first instance, I looked over the entire surface at fairly low power, fairly low power of the microscope, to be sure that there were no evident irregularities, and then examined specimens taken at random at higher

power, so as to convince myself that these were representative specimens taken from that bulb, the various zones of that bulb.

Q. 140. Did you take any photomicrographs of the surfaces of any of these bulbs?

A. Yes, of those that are marked with the asterisk in that table; two lamps from each lot.

[102] Q. 141. I show you a book of photomicrographs, entitled "Photomicrographs of Jewel Inside Frosted Bulb Surface" and ask you whether you can identify these as photomicrographs of these lamps that you said you photographed?

A. Yes, they are.

Q. 142. Turning to page one I again note that the legend at the top bears the marking "Zone A", on page two Zone B, page three Zone C. Do I understand that the zones of each of these lamps were marked out in the same manner as you testified the G. E. lamps were when you made your microphotographs of those lamps?

A. In just the same manner.

Q. 143. And the characters under the zone enumeration stand for the number of the fragment that was photographed?

A. That is right.

Q. 144. Now, what is the magnification of the photomicrograph shown in this picture?

A. These are of both the illumination transmitted and illumination reflected, taken at a magnification of 1100 times.

Q. 145. What was the magnification that the photomicrographs shown in the General Electric book Plaintiff's Exhibit 16 were taken at?

A. Just the same, 1100 times.

Q. 146. Now, will you tell me whether or not the photographs shown in this book are characteristic of [103] the surface of the lamps from which the particular fragments came?

A. They are.

Q. 147. And what is the nature of the surface of the fragments as shown by the pictures in this book?

A. Well, all of them show this type of structure that I have talked of before, that is elevations surrounded by rounded depressions, depressions with rounded bottoms.

Q. 148. And how does the nature of these different surfaces compare with the surface shown in the photomicrograph, plaintiff's exhibit 16 of the General Electric lamp?

A. They are the same except for slight variations of pattern, slight variations of size. In all instances the protuberances, the projections vary in size. Some of them are not so large, some not so small.

THE COURT: Well, your method does not control the size?

THE WITNESS: No, it doesn't control the size, that is right.

THE COURT: It depends upon the surface exposed to the action of the acid and the extent of the exposure which is apt to occur in a process of this type?

THE WITNESS: There is some control by means of [104] changes in the acidity, in the temperature and in the amount of ammonia present.

Q. 149. Now, am I correct in my understanding that in this book of Jewel photomicrographs there are shown pictures of four separate lamps and of three fragments from each of those four separate lamps?

A. That is right.

Q. 150. And with respect to each fragment there are two pictures on each page of the same fragment?

A. That is right.

MR. NEAVE: I offer in evidence a book of photomicrographs of Jewel inside frosted bulb surfaces.

MR. DARBY: No objection.

(Marked Exhibit P-19.)

Q. 151. Did you testify in the case of General Electric v. Wabash?

A. I did.

Q. 152. I show you a reproduction of plaintiff's exhibit 17 on page 117 of the record General Electric v. Wabash which is a photomicrograph of a surface of the defendant's lamps in that case, inside frosted lamps. Will you please examine that? I ask you how the surface as shown in that photograph compares with the surfaces shown in plaintiff's exhibit 19 which are the photographs of the Jewel lamp?

[105] A. This surface is the same but down at the bottom you will see the legend "magnification 3,000 times." The magnification of 3,000 times was correct for an 8 x 10 print. This print has been reduced in copying. The surface is the same. There are projections surrounded by depressions with rounded-out bottoms.

Q. 153. I show you volume two of the record of General Electric v. Save Sales Company and others; on page 388 are microphotographs entitled, "Plaintiff's exhibit 7." Will you please examine that and tell me how those compare with the surfaces shown in the micrographs in plaintiff's exhibit 19 in this case?

A. Again remembering that the magnifications as shown here are labelled 1100 times which means that the original photomicrograph which was 5 x 7 inches is 1100 times and not the reproduction as shown here in the book, the surface again is the same, that is we have these projections which are surrounded by depressions with rounded-out bottoms. The texture may vary a bit and the size of the individual projections are not all just the same, but the surface is the same.

Q. 154. Will you refer again to the chart of bump tests and maximum brightness of Jewel lamps and tell me whether the strength of the lamps which are shown in plaintiff's exhibit 19 was more than 45 per cent. of the corresponding [106] clear bulb?

A. Yes, they were.

Q. 155. Did you arrange with Henry F. Kurtz of the Bausch & Lomb Company that he should take stereoscopic photomicrographs of certain of the Jewel bulb surfaces which you yourself photographed and which are included in plaintiff's exhibit 19?

A. I did.

Q. 156. Which ones were they?

A. The ones that I sent to Mr. Kurtz were marked CII; another was CVIII.

Q. 157. Just a minute, CII, is that of the surface shown on page two of plaintiff's exhibit 19?

A. That is right.

Q. 158. And is CVIII that shown on page 8 of plaintiff's exhibit 19?

A. That is the fragment.

Q. 159. Were there any others?

A. Yes. I sent him one. There is one here of a G. E. lamp which was marked XXI.

THE COURT: What page?

Q. 160. Is that the fragment a picture of which is shown on page 2 of plaintiff's exhibit 16?

A. That is the one.

Q. 161. Have you compared the pictures which Mr. Kurtz made with the fragments to determine whether [107] in fact they are pictures of those fragments?

A. I have done so and they are.

CROSS-EXAMINATION.

By MR. DARBY:

XQ. 162. You were with the General Electric Company when it first began to produce inside frosted lamps commercially, were you not, Mr. Spencer?

A. Yes, sir.

XQ. 163. And you are familiar with the process used by the General Electric Company in its first commercial production of inside frosted lamps?

A. I am.

XQ. 164. Will you tell me precisely what procedure was followed in the first commercial production giving each step?

A. Yes. In the first commercial production the bulbs were loaded into a tray and moved over a series of nozzles just about as we make them today; but in the first position on the machine, the frosting position, the etching medium is squirted into the bulbs just as we do it today.

XQ. 165. Just one squirt or a number of squirts?

A. Oh, no, a number of squirts, depending somewhat on the size of the bulb.

XQ. 166. And the reason why you give it a number of squirts, rather than just one squirt was to make sure that [108] all of the bulbs would be covered by the etching solution and be evenly distributed, is that right?

A. Evenly distributed, sir.

XQ. 167. Go on.

A. Then this tray was moved by a pneumatic device over to another position on the machine and there was washed with hot water.

XQ. 168. At about what temperature?

A. About 130 to 140 Fahrenheit; again moving to a successive position it was then treated with a weaker etching acid again squirted in.

XQ. 169. This was the second etching treatment, the strengthening treatment?

A. This is the strengthening treatment. They are then moved through another washing stage, or were moved through another washing stage, drawn through a tunnel dryer——

XQ. 170. Was that warm water or cold water, the second washing stage?

A. Warm water.

XQ. 171. At what temperature?

A. About 130 to 140 degrees.

XQ. 172. And when did you first change that process in the commercial production of lamps?

A. A year or two after we went into production.

XQ. 173. And what was the change that was made?

[109] A. The change that was made was to eliminate the washing step immediately after frosting.

XQ. 174. And when was the next change made in the process?

A. I don't understand.

XQ. 175. Was there any change ever made in the process in producing commercial lamps after that, or have you always continued exactly this process as changed a year or two after you first went into commercial production?

A. There may have been minor variations in the strength of acid since we have gone over to using the reclaimed ammonium bifluoride which was the reason for the elimination of the washing step because we could reclaim the acid from the bifluoride, but except for minor variations it is the same.

XQ. 176. Then, as I understand it the reason for your change was to enable you to reclaim the etching solution or the acid solution?

A. The ammonium bifluoride.

XQ. 177. The ammonium bifluoride which is included in the etching solution?

A. That is right.

XQ. 178. And economically it is desirable to reclaim chemicals like that?

A. It is, sir.

[110] XQ. 179. Have you, since you first began the production commercially of inside frosted lamps, used the same etching solution, or have you during the period of time changed that etching solution?

A. Not except for minor changes in acidity, say a slight change such as two or three per cent., something like that. Otherwise the composition has been substantially the same.

XQ. 180. Has there been any change in the temperature at which the etching solution was maintained at the time it was injected into the bulb?

A. No.

XQ. 181. That has always been the same. Incidentally what is the temperature?

A. Of the etching solution?

XQ. 182. Yes.

A. The thermostats are set for about 150.

XQ. 183. Fahrenheit?

A. Yes, sir, Fahrenheit.

XQ. 184. Are you familiar with the solutions that are stated in the Pipkin patent?

A. Yes, I think so.

XQ. 185. The General Electric Company has never nsed either of the solutions given in the Pipkin patent commercially, has it?

[111] A. I don't remember ever having knowledge of them using it for that purpose, no.

XQ. 186. And your answer would be the same, not only as to the constituents of the solution, but also the percentages given in the patent, would it not?

A. You are talking of inside frosted bulbs?

XQ. 187. Yes.

A. Not for inside frosted bulbs, no.

XQ. 188. Your answer would be the same?

A. That is that we have not used it for inside frosted bulbs.

XQ. 189. That is right?

A. That is right.

XQ. 190. Will you please refer to the photomicrographs that you have made of the General Electric lamps, that is plaintiff's exhibit 16, I think; those photomicrographs were made recently, were they?

A. Yes, they were.

XQ. 191. Of current commercial products of the General Electric Company?

A. That is right.

XQ. 192. In those photomicrographs do you find any sharp angular crevices at all?

A. No, no sharp angular crevices.

[112] XQ. 193. There is no sharp angular crevice anywhere in those microphotographs so far as you are able to tell?

A. Not in the depressions, Mr. Darby. There may be on top of the pyramid.

XQ. 194. No, I am referring to the crevices, which I think we both understand means the depressions.

A. That is right.

XQ. 195. And you find no sharp angular crevices at all?

A. No.

XQ. 196. All of the sharp angular crevices that may have existed in those glass surfaces have been rounded out, is that right?

A. Yes.

XQ. 197. Now, will you refer to the Jewel, plaintiff's exhibit 19—first let me ask you, have you examined all of these photomicrographs to determine whether or not you can find any sharp angular crevice as distinguished from a rounded crevice?

A. I have, sir.

XQ. 198. You have examined each one carefully. Have you been able to find any sharp angular crevices?

A. Not that I would call sharp angular crevices, no, sir.

XQ. 199. Well, can you point to any one of the photographs where you have found something that you apparently have in mind in answer to my last question [113] that you don't characterize as a sharp angular crevice but which might be characterized by some other term?

A. No; what I had in mind, Mr. Darby, is I cannot conceive of any two intersecting planes save intersecting mathematical lines that wouldn't happen on a glass surface—you are talking about a surface down to one molecule?

XQ. 200. Let me put it this way; maybe it will simplify it. Do you find any crevices in the microphotograph of the

Jewel lamp which you would not characterize as rounded to the extent that you have rounded depressions in the microphotographs of the General Electric lamp?

A. You mean by that there may be some in the Jewel that have a less radius of curvature?

XQ. 201. Yes, I mean to include that.

A. Than the very smallest on the G. E.?

XQ. 202. Yes.

A. I am not so sure. There are probably some that have a less radius of curvature than the average of the General Electric.

XQ. 203. As a matter of fact most of them have less radius of curvature than the average of the General Electric Company, do they not?

A. Yes, I would say so.

XQ. 204. But what I am getting at precisely is this: [114] do you not find in the microphotographs of the Jewel lamps instances where the depressions between the walls which form the crevices are only slightly rounded with substantially flat portions?

A. Substantially flat portions on the side?

XQ. 205. No, substantially flat portions at the bottom?

A. Well, if they are substantially flat at the bottom, then they have an infinite radius of curvature.

XQ. 206. Well, all right. Do you find any depressions in the Jewel lamps which have substantially flat portions?

A. The very bottoms of these rounded depressions are flattened. How best express that?

XQ. 207. In the photomicrographs that you have made of the depressions in the General Electric bulbs, particularly in the case of reflected light, I noticed that there seems to be a point of light in the approximate center of each of the depressions; that is characteristic of a photograph of a rounded surface taken by reflected light, is it not?

A. A spherical surface, yes.

XQ. 208. And the depressions in the General Electric lamp are practically or predominantly of the spherical type, are they not?

A. Yes, they are.

XQ. 209. Now, is it not the fact that if you take a photograph of a substantially flat surface by reflected [115] light instead of obtaining a point of light you will obtain a substantially wide area of light in the photograph?

A. That is right.

XQ. 210. In connection with the bump and maxium-brightness tests that you made with the Jewel lamp, I notice that you compared it in each instance with a clear bulb, that is, you compared the inside frosted bulb in each instance with a clear bulb. Where did you get the clear bulb that you made the comparison with?

A. That is one of General Electric's clear bulbs.

XQ. 211. One of General Electric's clear bulbs?

A. That is right, sir.

XQ. 212. You didn't make a comparison with a Jewel clear bulb, did you?

A. We couldn't get any.

XQ. 213. Your answer to my question then——

A. Is no.

XQ. 214. Is no. Did you analyze the glass of the bulbs of the Jewel Company, the Jewel lamp—yes or no, please?

A. I didn't run a quantitative analysis, only a qualitative analysis to show the absence of lead and the presence of lime in quantity which would identify the glass as a soda-lime glass.

XQ. 215. And I think you agreed with the court's expressed thought that the effect of an etching fluid [116] on any glass is dependent upon such items as the particular etching fluid that is employed, its temperature and the material on which the etching fluid is applied?

A. I did.

XQ. 216. In the prior testimony that you gave in the case of General Electric Company v. Wabash, the record of which is in evidence as Plaintiff's Exhibit 11, you gave this testimony, did you not, XQ. 182, page 127 of the record——

THE COURT: Are there some copies of that around? There might be enough to give him one.

THE WITNESS: It is all right, your Honor. I can read from this.

"XQ. 182. Now, I think you have testified that this rounding effect is obtained exclusively by this second or reinforcing treatment, is that right?

"A. Yes.

"XQ. 183. Do you know of any other way of rounding out these sharp crevices effected by an etching, a preliminary etching of a piece of glass, other than subjecting it to this second reinforcing treatment?

"A. Do you mean any other solution?

"XQ. 184. No, any other way of doing it other than [117] by a second treatment.

"A. A second treatment of the same kind?

"XQ. 185. A second etching treatment.

"A. I don't know of any way of doing it and of maintaining a diffused surface for practical application for lamps.

"XQ. 186. Than by this second etching treatment, is that right?

"A. Yes."

You so testified, did you not?

A. Yes, sir.

XQ. 217. And that testimony was true to the best of your knowledge and belief at the time that you gave it?

A. Yes, sir.

XQ. 218. And still is?

A. I think it is, sir.

XQ. 219. Now, with respect to the photomicrographs of the General Electric lamp, this Plaintiff's Exhibit 16, it is a fact, is it not, that the crevices in the General Electric lamp as shown by that photomicrograph are uniformly rounded?

A. You mean they are all perfectly spherical? No, I wouldn't say so.

XQ. 220. I don't mean that they are all perfectly spherical, they are uniformly rounded, they are uniformly [118] of the same shape; look at your photomicrographs before you answer the question.

A. I think I understand what you mean. They are of varying sizes.

THE COURT: Have all the angular surfaces been eliminated, is that what you wan Mr. Darby?

MR. DARBY: That plus the fact that they are all of substantially the same shape, all of the rounded depressions are of substantially the same shape, though perhaps differing in size.

THE COURT: Out of three questions there ought to be one he could answer.

A. I think I understand what Mr. Darby means. Yes, in that all circles are similar and all ellipses are similar; then I would say if that is what you mean they are substantially of that character.

XQ. 221. Accepting and retaining that same meaning would you say the same is true with respect to the Jewel surfaces?

A. There are on the Jewel surfaces some trough-like remnants which have resulted from a chain of these little hemispherical depressions, running into each other. They would be, I would say, more trough-like than on the General Electric. They have resulted from the same reason.

XQ. 222. That would lead me to the next question then [119] which is, in the General Electric bulb would you say that each crevice is rounded to substantially the same extent?

A. There is a certain minimum radius of curvature on the G. E. and there are crevices that have a radius of curvature bigger than that minimum.

XQ. 223. Couldn't you answer my question?

A. I tried to, sir.

XQ. 224. Would you say that all of the crevices in the G. E. lamp are rounded to substantially the same extent?

A. Well, that is just what I tried to say, that they have all reached a minimum radius of curvature. There are some bigger than the minimum, quite a bit larger, but those that are the small ones are of a minimum radius of curvature.

XQ. 225. Then you would not say that they are all rounded to substantially the same extent?

A. No, not in the way that you mean it.

XQ. 226. Will you refer to the Jewel exhibit microphotographs Plaintiff's Exhibit 19, and turn to the first page, if you will, please, as illustrative of what I have in mind. As I understand your testimony the rounded crevices are indicated, for example, by the area I am tracing with my pencil and which contains what looks to be pearls, black pearls if I can use a crude illustration, is that correct?

A. Yes.

[120] XQ. 227. And it is your testimony that these black pearls indicate the rounding of the crevices, or shows where the rounded crevices are, right?

A. Yes.

XQ. 228. Now, I take you to an area immediately to the right which seems to consist of, for purposes of identification, a series of very small pearls, extending from a large one in more or less fan-shape. Do you see where I mean?

A. Yes, I see.

XQ. 229. And you accept my description of that location?

A. Yes.

XQ. 230. What are they; are they crevices?

A. Yes.

XQ. 231. They are crevices and have they been rounded out?

A. Yes.

XQ. 232. And the little things which for want of a better term I call pearls, those are all the individual pits, are they?

A. They represent the portion where the light—you are pointing to the illumination reflected photomicrograph?

XQ. 233. That is right.

[121] A. They represent the portion where the light is thrown back, yes.

XQ. 235. From individual little pits?

A. Yes.

XQ. 236. A lot of them close together?

A. Yes, there are a number there all opening into each other, a chain of them.

XQ. 237. And that is a characteristic that you see in several places in the Jewel lamp, do you not?

A. Yes, I see them.

XQ. 238. Do you see anything like that in the General Electric bulbs, in your photomicrographs? If so, will you please point to them?

A. Yes. On the first page, page 1, we have a chain of them here. Can I mark that by two lines? One here and the second here surrounding or at the bottom of illumination reflection page 1.

MR. NEAVE: May I suggest that it be marked on the copy in evidence? This is not the one in evidence.

THE COURT: Mark it in red and it won't look like any other pencil mark that happens to get on there.

[122] A. At the area at which the two intersecting red lines converge there is a chain of these little hemispherical depressions which have opened out into each other, that is this area here.

MR. NEAVE: Speak a little louder, please, Mr. Spencer.

A. (Continuing.) Oh, yes, here they are. I will mark that in pencil, the illumination reflected and the illumination

transmitted. The photomicrograph is moved over just a little bit.

XQ. 239. I see. Now, will you for the court put the tip of your pencil, and I will arrange with counsel so we can mark it permanently on the line of small depressions in the reflected light illumination photomicrograph that you referred to?

A. Yes, sir.

(Witness does as requested.)

XQ. 240. Now will you put the tip of your pencil on that same series of depressions in the transmitted——

A. Yes, sir.

XQ. 241. Will you mark that line A——

A. I think I can mark on it, sir.

XQ. 241. (Continuing.) —in both photomicrographs.

(The witness complied.)

XQ. 241. (Continuing.) And drawing a ring around it.

[123] (The witness complied.)

XQ. 241. (Continuing.) All right, thank you.

XQ. 242. Just one more question, Mr. Spencer. You have throughout your testimony used the term "rounded", in referring to these pits or depressions. Now, will you give me your definition of the word "rounded" as you have used it in your testimony?

A. Well, as I said, Mr. Darby, I don't believe that any two real planes would intersect in a mathematical line. So there is some radius of curvature, where two real planes would intersect. If you carried it to reductio ad absurdum, certainly it couldn't be less than one molecule radius of curvature. It is probably quite a number of them. But we know that where these two real planes do intersect, on a frosted surface, you do get a radius of curvature that results in weakness. And you can see the effect of the treat-

ment in rounding out that crevice, and you know from observation of the surface and from other ways of proving to yourself, that the radius of curvature on a so-called fortified surface is greater than the radius of curvature here on the etched and untreated surface.

XQ. 243. I wonder if you understood my question?

A. That is my definition of rounding out, sir.

XQ. 244. Oh, you intend that to be your definition of "rounded" in response to my question, as you have [124] used the term in your testimony?

A. I don't see how I can make it any plainer.

XQ. 245. Well, I am not asking you to make it any plainer if you think you have answered it.

A. No, I understand. I should like to answer it for you. You would have zero radius of curvature where two hypothetical planes intersect.

XQ. 246. Let me put it this way: is that the best answer to my question that you believe you can give me? If it is, I am satisfied.

THE COURT: I don't know how he can do any better with it.

A. I think it is, sir.

MR. DARBY: I don't, either. All I want to do is to get something in the record as to the witness' definition of the term as he has used it in his testimony.

THE COURT: It would seem to indicate, the term, a series of concave-like surfaces, not uniform in size, not uniform in depth, but from perspective looking exactly as in exhibit P-15, I think. I don't see how he could describe it any better. Maybe you can suggest a description; I don't know.

MR. DARBY: I merely wanted to make a matter of record this witness' definition of the term that has

been used; and, as your Honor sees, it is an [125] important term in the case.

THE COURT: I know. He has used it in his claim. As I understand the law, inventors are not necessarily to be penalized, assuming this is an invention, by reason of their failure to adequately express the invention, if it is adequately defined; the mere failure of expression wouldn't defeat the claim.

MR. DARBY: Of course not.

THE COURT: Failure to define it adequately would defeat the claim.

MR. DARBY: Certainly; I agree with your Honor——

THE COURT: If he failed in arriving at a true definition of a rounded surface, it wouldn't defeat the invention, assuming it was an invention.

MR. DARBY: Of course not, and I wouldn't contend that it did. There is one little phase of it, however. The inventor has all the choice of the English language in defining his monopoly.

THE COURT: That is right.

MR. DARBY: And if he unfortunately uses a term which requires definition, in order to establish the limits of the monopoly, that is truly a misfortune on his part; unless a definition is given in the patent.

I think that is all.

[126] RE-DIRECT EXAMINATION.

By MR. NEAVE:

RDQ. 247. Now, Mr. Spencer, you have taken both transmitted and reflected light pictures. In your opinion

which type of picture more accurately represents the surface photographed?

A. The photomicrographs marked "Illumination Transmitted" give us a much clearer picture of what the depressions look like. And that is the reason I have used transmitted light in this instance. Now, reflected light will give you a better picture of what the projections, the protuberances, look like, but they are not of any importance here; it is the depressions that we are concerned with.

RDQ. 248. And you prefer the transmitted light pictures?

A. Yes.

RDQ. 249. To view the depressions?

A. Yes; a much clearer picture of the depressions.

RDQ. 250. Have you ever treated clear bulbs with either of the frosting solutions, the specific frosting solutions, that are mentioned in the Pipkin patent?

A. Yes, I have.

RDQ. 251. Have you ever bump tested the bulbs that you so treated?

A. Yes, I have.

RDQ. 252. What did you find was the strength of those bulbs?

[127] A. They are substantially as strong as the clear bulbs.

RDQ. 253. I am talking about Pipkin frosting solution alone.

A. Oh, not the treated ones?

RDQ. 254. No.

A. When the bulb is treated with a frosting solution as described exactly as in the Pipkin patent, there is a very rapid diminution in strength.

RDQ. 255. Can you tell me——

A. Yes; I was going to say the test, the bump test strength, decreases from, say, for a clear bulb, of forty-five or fifty, down to a bump test of two or three, for the frosted bulb, frosted only.

RDQ. 256. Would you say that the curves shown in the Pipkin patent of the decrease in strength of the bulbs when treated by the frosting solution only are substantially correct?

A. They are.

RDQ. 257. Now, have you then taken such frosted bulbs and given them the specific treatment which Pipkin describes in his patent for treating or fortifying the bulb?

A. I have.

RDQ. 258. And have you bump tested such bulbs?

And if you have, what was the result?

A. Yes. And treated exactly as described in the patent, [128] the bump test strength is restored to that of practically the clear bulb itself.

RDQ. 259. Do you know whether or not either of the frosting solution recipes given in the Pipkin patent was ever used by the General Electric Company for the frosting on the outside of bulbs?

A. Yes. The one described by Pipkin is an excellent frosting medium, and of just about the same general nature as the one used by the G. E. for outside frosting.

RDQ. 260. Would you say that it was correct to state that the reasons why the changes were made in the General Electric process as described by you on your cross-examination were in order to increase the speed of production and save in materials?

A. Yes, to be sure. The first step, washing step, that I described for Mr. Darby is wasteful of ammonium bifluoride and that is an expensive ingredient of a frosting mixture, and you can so arrange to conserve that and use it over again, and we do.

MR. NEAVE: That is all.

RE-CROSS-EXAMINATION.

By MR. DARBY:

RXQ. 261. I take it, Mr. Spencer, from your last few answers, that the General Electric Company is still producing outside frosted bulbs?

[129] A. Outside frosted. I have a list with me. I can tell you. I don't recall from a special list offhand just which——

RXQ. 262. Didn't you just tell Mr. Neave that the etching solution that is given in the Pipkin patent is used by the General Electric?

A. I said had been used.

RXQ. 263. Oh, had been used?

A. Yes. Pardon me if I didn't make that clear. It was in the past tense.

RXQ. 264. When was that used, Mr. Spencer?

A. Oh, say 1912.

RXQ. 265. And it has not been used since in commercial production?

A. It was so much easier to use the frosting mixture that we have.

RXQ. 266. Answer my question. It has not been used for the commercial production of anything so far as you know?

A. I don't know. It may have been.

RXQ. 267. You don't know of your own knowledge that it has been?

A. No, I do not.

By The Court:

Q. 268. Just one question, Mr. Spencer. Have you [130] read the Wood patent?

A. Yes, sir, I have.

Q. 269. And have you noticed particularly the method prescribed for the manufacture of a screen?

A. Yes, sir.

Q. 270. If you followed his method without any thought of strengthening the bulb, you would have produced a bulb as manufactured under the Pipkin patent, isn't that right?

A. Not so far as the diffusion goes; you see the diffusion is very important.

Q. 271. I am talking now, you would have produced the strengthening result even though you never intended it, isn't that right?

A. Oh, I think a bulb if sandblasted as he describes and then sufficiently treated with acid would become stronger; if you eat off the frosting layer that you have developed by sandblasting then certainly it will be strong. Hydrofluoric acid alone does not weaken.

Q. 272. The method described in his patent would have produced the same result described in the Pipkin patent, even though the result was not described in the Wood patent, isn't that right?

A. I would like to make this clear as to what your Honor is referring to. You are speaking now of strength?

Q. 273. Strength of the bulb.

[131] A. Strength only?

Q. 274. Yes.

A. I think it would be strong, but the thing that Wood was talking about are great big saucer-shaped things and what we are talking about here are the production of these little depressions on a surface, and there may be as many as five or six million of them to the square inch, and that is what gives you diffusion in the lamp. Wood is trying to get a screen which lacks diffusion. All he wants is to stop your visual perception at a certain place and not to diffuse the light.

Q. 275. Let me read to you from Wood: "Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing the very marked loss in the efficiency of the lamp, which results from frosting the bulbs in the usual manner." Bearing in mind——

A. He is talking about outside frosting.

Q. 276. Bearing in mind that his patent is directed toward a method—I realize that Judge Simon made that distinction of outside and inside frosting. Personally I don't see it.

A. It makes a big difference, your Honor, so far as absorption goes. An outside frosted bulb absorbs a lot more light than an inside frosted bulb. It may be the outside frosted amounts to five or six per cent., the inside frosted may be one-half per cent.

[132] Q. 277. Bearing in mind both the Kennedy patent and the Wood patent, combining therein the two very simple methods described you could have produced a bulb having the strength of your bulb by mere accident without ever knowing that that was the result, isn't that so?

A. Just strength alone?

Q. 278. Yes, I am talking about strength.

A. Yes, I don't argue against that; it should be strong. It would have to be strong.

Q. 279. Now, coming back to another very simple principle, what causes your bulb to be stronger by reason of the inside frosting and then the subsequent elimination of the angular surfaces, do you know?

A. I think so, sir.

Q. 280. All right. Tell me.

A. Well, it is just like a diamond scratch on a piece of glass. A diamond scratch is a sharp angular crevice, a very, very small radius of curvature, but you could use a material like one of the transparent synthetics in which you could mill that, turn the surface and if you milled into that surface depressions, v-shaped notches with various radius of curvature, you would find one of those present on the surface by putting it under cross-bending test that the smaller the radius of curvature at the end of the milled notch the weaker the material would be, [133] and if you round out by any means the end at the vertex of that trough or depression you would have in the surface a v-shaped notch. You restore the strength when you have reached a certain radius of curvature; the restoration of strength is not instantaneons, it isn't just a weak bulb and a strong bulb.

Q. 281. The strengthening arises from diminishing the cleavage which causes the weakness, isn't that right? In other words we will assume that is a glass tube and I strike across the upper edge with a file presenting a mark. I then place my thumbs below the mark and my forefingers on either side of it and bend down and it breaks at the point?

A. Yes.

Q. 282. Coming back to your old bulb had I pressed upwards the tube would not break?

A. No.

Q. 283. Because I am then moving to the cleavage and not away from it?

A. Yes.

Q. 284. So I pull the cleavage apart?

A. Yes.

Q. 285. Now, taking the instructions of the Wood patent and applying a very simple well-known principle, why wouldn't the Wood patent teach you the result that [134] you ultimately arrive at in the Pipkin patent?

A. Well, I suppose it is because——

Q. 286. I am talking to you now as a person skilled in this field.

A. Yes, yes, I understand, your Honor. I would think it is because no one before Pipkin recognized the presence of these sharp angular crevices, or correlated, rather, correlated their presence, with strength or weakness.

Q. 287. They didn't? After all that was known, the mere breaking of glass at the point of cleavage—no one ever thought that it was the angular surface in the bulb that was causing it to break?

A. Well, there are six or seven million of these things per square inch, your Honor, on a frosted surface.

Q. 288. And you mean they never knew until Pipkin that they existed in a frosted bulb?

A. I don't think so; or correlated their presence, with weakness or strength.

Q. 289. Are you familiar with the methods followed for a hundred years of marking graduates——

A. Yes.

Q. 290. And thermometers?

A. Yes, sir.

[135] Q. 291. By applying a wax surface?

A. Yes.

Q. 292. And marking in the wax a point at which the hydrofluoric penetrates and makes a mark?

A. Yes.

Q. 293. A sharp cleavage?

A. Yes.

Q. 294. And you say that it wasn't known that that did that to a bulb?——

A. There is, I think——

Q. 294. (Continuing) —except in greater quantity, in numbers of sharp surfaces?

A. There is, I think, a big distinction, when you think of how minute these things are. Now, it was known, and the prior art discloses, methods of treating frosted surfaces with another acid, to change the appearance, the physical diffusion; but the thing that was not known was that you could treat this type of a surface with five or six million of these little things per square inch, and treat it in such a manner that you preserve the diffusion and, rather, increase the strength, to practically that of a clear bulb, and preserve the diffusion. To be sure, you can eat it all off and then you know that you are back to a strong surface.

Q. 295. And without diminishing to any marked degree [136] the efficiency of the lamp; is that right? In other words, you say you have a diffusion, not too great——

A. Very poor.

Q. 295. (Continuing) —so far as the efficiency of the lamp is concerned?

A. Very poor diffusion.

Q. 296. Very poor?

A. Yes.

Q. 297. That preserves the efficiency of the lamp?

A. Oh, yes, that——

Q. 298. Giving you a sufficient surface to protect against the glare?

A. Oh, no, no, I don't think so, sir.

Q. 299. What would it give you?

A. Well, these surfaces here——

Q. 300. Yes.

A. (Continuing) —or the Pipkin surface, reduces the brilliancy of a filament to about one percent of that of a clear bulb. Now, the Wood surface must be something like, oh, roughly, say, fifty percent, if it is that much. It isn't a matter of a few percent of the brightness of the clear bulb, or the clear filament. It is nothing of the order of magnitude about which we are talking here.

Q. 301. You are talking about the efficiency of the [137] operation, you see. I am talking about the fundamental principle of the operation. There has been any number of operations which, as you know, we still follow. They are old.

A. Yes.

Q. 302. But have been so improved that we hardly recognize the fundamental principle any longer. —What I am asking you is this: whether or not there does not exist in the Wood patent a teaching which if followed would have produced the result that you have in the Pipkin bulb; except that you get an improved result, we will say, a better bulb?

A. Well, we get one that has a usefulness so far as the elimination of glare goes. That is, it is one percent of the brightness of the clear bulb. You can preserve that diffusion and still make the bulb strong.

THE COURT: Well, you will insist on selling me bulbs. All right, go ahead. That is all. I have nothing further.

RE-DIRECT EXAMINATION.

By MR. NEAVE:

RDQ. 303. Mr. Spencer, is there any teaching or disclosure in the Wood patent that he is going to apply this treatment to the inside surface of a bulb?

A. Certainly not, no.

[138] RDQ. 304. Is there any teaching or disclosure in the Wood patent that the rounding of these crevices has any effect upon strengthening any kind of a glass surface?

A. No.

MR. NEAVE: That is all.

MR. DARBY: No questions.

THE COURT: Mr. Neave, my question goes beyond your last question. I am thinking of the poor unfortunate who, without any thought of strengthening his bulb, might have followed the teaching of the Wood patent and have gotten a result, maybe not as good as yours, but sufficient for your client to come into court and charge him with infringement.

MR. NEAVE: I understand that; I understand what you are talking about, your Honor, but our position, of course, is this: that there is no teaching in the art of these things; that if they did occur, as following the process described, if these things were combined, which is not suggested, that they should be, that might be the accidental result; and then I am perfectly willing to argue with your Honor at the proper time——

THE COURT: Oh, yes, I understand that under the law the mere combining of elements wouldn't establish [139] anticipation. I mean I realize that we can't take a number of teachings of unrelated arts and put them all together and arrive at anticipation. I understand that.

MR. NEAVE: But in addition to that, my position is that where there is no teaching of the result that you want to achieve, an accidental result won't anticipate a patent, if you accidentally adopted that.

THE COURT: Yes, I understand. The accidental result might have produced an infringement, though.

MR. DARBY: May I change my mind about asking this witness one or two questions?

THE COURT: Oh, surely.

MR. DARBY: Along the line of your Honor's examination; because I would like to crystallize one or two things.

RE-CROSS-EXAMINATION.

By MR. DARBY:

RXQ. 305. Is it a fact, Mr. Spencer, that if you take a piece of glass, let's take a piece of flat glass, and you subject it to the action of an etching fluid, that glass is weakened to the strength that the etching fluid has eaten away part of the glass? That is a fact, is it not?

A. Reduction in wall thickness, you mean? Yes.

RXQ. 306. All right. That is point one. If that single etching treatment produces sharp angular crevices, that weakness can be cured or can be improved, it can be [140] made stronger by rounding out those sharp angular crevices?

A. Yes.

RXQ. 307. Is that right?

A. Yes.

RXQ. 308. Therefore, anywhere anyone in the prior art that subjected a piece of glass to an etching or a sand-blasting operation and thereafter subjected it to a second treatment, which rounded out the crevices, left by the first

step in the process, inevitably and unavoidably strengthened the glass over its condition of strength at the end of the first etching operation, isn't that a fact?

A. If the radius of curvature at the vertex of those cracks is increased, then the strength would be increased.

RXQ. 309. And that happens inevitably and unavoidably if the angular surfaces are rounded out?

A. If the treatment is such as to round out the crevice, then the strength is increased, yes.

RXQ. 310. And it is inevitable and unavoidable?

A. Not with all solutions, Mr. Darby, all etching mixtures, no, because a frosting mixture won't do that.

RXQ. 311. Well, now, wait a minute. If it rounds out?

A. Oh.

RXQ. 312. If it rounds out?

[141] A. If it rounds it, sir, yes, yes.

RXQ. 313. It is inevitable and unavoidable that you are going to get a stronger glass than it was before you rounded it out?

A. Oh, yes, yes, I agree.

MR. DARBY: That is all, thank you.

RE-DIRECT EXAMINATION.

By MR. NEAVE:

RDQ. 314. Well, Mr. Spencer, just one more question, do you know of any teaching, disclosure, in any of the patents or publications that were cited in any of the previous cases tried on this patent, or cited in this case, in which there is a disclosure that the rounding out of these crevices has any effect on strength?

A. No, sir.

MR. NEAVE: That is all.

(Following a short recess at this point the trial was resumed as follows.)

[142] HENRY FREDERICK KURTZ, called and sworn for the plaintiff, testified as follows:

DIRECT EXAMINATION.

By MR. NEAVE:

Q. 1. Mr. Kurtz, do you reside at Rochester?

A. Yes, I do.

Q. 2. New York?

A. Rochester, New York.

Q. 3. By whom are you employed at the present time?

A. I am employed by the Bausch & Lomb Optical Company.

Q. 4. What is your position there?

A. My title is that of chief designer of optical instruments. I am a member, senior member, of the Scientific Staff, especially assigned to those duties.

Q. 5. Are you trained in optical engineering?

A. Yes, I am trained in optical engineering.

Q. 6. Where did you have that training?

A. I had that training at the University of Rochester.

Q. 7. Are you a member of any learned societies?

A. I am a member, officer and director of the Optical Society of America, and a member of the American Society of Mechanical Engineers, a member and director and past president of the Rochester Optical Society.

Q. 8. Have you made a special study of orthostereoscopy?

A. Yes, I have.

Q. 9. Can you explain as simply as possible what [143] orthostereoscopy is?

A. Perhaps the easiest way to explain it will be to say in the beginning that stereoscopy is the production of images by optical means which are charactized by plasticity. That is, those images have three dimensions, as differentiated from the image that you see on the ground glass of a camera, for instance, which has only two dimensions. Or-

thostereoscopy is the special kind of stereoscopy in which those three dimensions are correctly related to each other. Stereoscopy, simple stereoscopy, in itself does not connote such rigorous relation of the three coordinate dimensions, but orthostereoscopy connotes such a strict proportional relation to each other.

Q. 10. The purpose of orthostereoscopy then is to try to reproduce and photograph the exact appearance of the actual article?

A. Yes. I can perhaps describe that by means of an example, enlarged slightly. If I were to take this package of cigarettes and hold it at a distance of, let us say, 500 millimeters, or approximately 20 inches, in front of my eyes and look at it, I see it exactly as it is, and that would be at unit magnification, since there is no optical element of any kind interposed between my eye and this package of cigarettes. If I were now to get some expert mechanic or artisan to reproduce for me this package of [144] cigarettes, let us say, ten times enlarged, make a replica of it, accurate in every tiny detail, color, form, with all the ripples and everything, exactly ten times as large as this, and if I were then to hold that replica in my hand again, at twenty inches from my eyes, what I would see then would be what you would see by virtue of orthostereoscopy had you done that by photography. This twenty inch distance that I speak of is one of a number of constants or factors in the establishment of orthostereoscopy that has to be rigorously held to and taken into consideration.

Q. 11. In connection with this work have you taken microphotographs by orthostereoscopy?

A. Yes, I have taken a great many.

Q. 12. Did you receive from Mr. Spencer of the General Electric Company fragments Nos. XXI, CII, CVIII? Did he ask you to examine these fragments and make orthostereoscopic microphotographs of them?

A. If you will repeat the symbols, please,——

Q. 13. XXI, CII, CVIII.

A. I did receive such specimens.

Q. 14. Did you examine these specimens under the microscope?

A. I did.

Q. 15. Did you make photomicrographs of them, using orthostereoscopy?

[145] A. I did.

Q. 16. Can you tell me the nature of the surfaces of all of these specimens?

A. They consisted of, to use the former verbiage of these proceedings, elevations and depressions. The depressions were invariably rounded; and there were interspersed throughout the field of view in these pictures, in the field of view in the microscope, pyramidal, hexagonal pyramids, which were, as I say, interspersed; the whole thing rather being heterogeneous in form.

Q. 17. I show you a pair of photomicrographs, upon one of which is marked "Top-left, XXI," and on the other "Top-right, XXI," and ask you whether you can identify these.

A. Yes, I do identify them, as photographs that I made.

Q. 18. They were made of the fragments bearing the same numerals?

A. They were.

MR. NEAVE: I offer those in evidence as Plaintiff's Exhibit 20.

THE CLERK: P-20 is marked "Top-left XXI," and P-20A is marked "Top-right XXI."

Q. 19. Mr. Kurtz, did you construct a stereoscope with which to view these pictures?

A. I did.

[146] Q. 20. Will you be good enough to examine these pictures through the stereoscope and describe what you see?

A. Well, what I see by looking in this is a plastic picture of the surface of this piece of glass that I photographed, and it is characterized by elevated portions and depressed portions; the bottoms of the depressed portions are rounded; some of the roundings run into one another and make lines. I see some hexagonal pyramidal projections extending upwards.

Q. 21. What is the magnification of these pictures as viewed through the stereoscope?

A. We attempted to make them 1200 times. They actually, because of the use of lenses available, came out slightly under about 1195, as closely as we were able to measure it.

Q. 22. I show you a pair of pictures, marked on one picture "Top-left, CII," and on the other picture, "Top-right, CII," and ask you whether you can identify these as pictures that were made by you, or under your direct supervision, of the fragments bearing the same numbers.

A. Yes, I do so identify them.

MR. NEAVE: I offer these in evidence as Plaintiff's Exhibit 21.

THE CLERK: P-21 on the top of the picture is marked "Top-left, CII"; P-21A is marked on the top, "Top-right, CII."

[147] Q. 23. I show you a pair of pictures, one of which is marked "Top-right, CVIII," and the other "Top-left, CVIII," and ask you whether these are pictures that were made by you or under your direct supervision of fragments marked with the same numerals.

A. Yes, I do identify them so.

MR. NEAVE: I offer these in evidence.

THE CLERK: P-22 is marked "Top-left, CVIII," P-22A is marked "Top-right, CVIII,"

Q. 24. Mr. Kurtz, referring to Plaintiff's Exhibit 21 and Exhibit 21A, which I think are in your stereoscope, will

you please tell me whether or not the surface shown in these photomicrographs is similar or dissimilar to that shown in Plaintiff's Exhibit 20 and Exhibit 21A.

A. If this is similar——?

Q. 25. Similar to the surface you just examined before, Plaintiff's Exhibits 20 and 21A.

A. This is 21A that I have in here. [Exhibit P-21 handed to the witness.] Yes, it is very similar. The difference perhaps is that there seem to be more of these hexagonal pyramids. Otherwise the surface is very similar.

Q. 26. Will you make the same comparison between Plaintiff's Exhibits 22A and Exhibits 20 and 20A?

A. Yes, the surface is again quite similar, except that there seem to be still a few more of the hexagonal pyramids.

[148] Q. 27. Can you tell me whether or not the representation shown of these three surfaces, as viewed through the stereoscope, is characteristic of the various surfaces as you examined them under the microscope?

A. Yes, they are.

MR. NEAVE: I think I had better offer in evidence the stereoscope, your Honor, because you can't view these pictures without this stereoscope. So I offer that in evidence.

THE CLERK: P-23.

MR. NEAVE: As Exhibit P-23.

CROSS-EXAMINATION.

By MR. DARBY:

XQ. 28. Mr. Kurtz, I understand you to say that in your opinion these surfaces are very similar; that is, the XXI's, on the one side and the C's on the other, are very similar?

A. Yes, yes.

XQ. 29. And all I want to do is to crystallize the matter, in which I know you will cooperate with me, in the few

instances of dissimilarity; and to facilitate it, so you can make ready comparison, I am going to put in my stereoscope, at least the one that Mr. Neave so kindly loaned me for purposes of examination, the two photographs, right and left, of the X; so that you can put in or the Court can put in his stereoscope the two CVXII photographs, [149] so that you and the Court can then very quickly look from one to the other. You have in the stereoscope in your hand the two XXI photographs, and I am going to put in the other stereoscope CVIII; and I am going to suggest that one dissimilarity between the two is in the size of the crystals. You agree to that?

A. You mean by crystals the——

XQ. 30. Pyramids.

A. The hexagonal pyramids.

XQ. 31. Yes.

MR. NEAVE: May I interrupt, Mr. Darby, a minute? I think, your Honor, you can see better if the light is evenly divided between the two pictures.

THE COURT: Yes. That's all right. I found a very satisfactory result this way. Don't change it.

MR. NEAVE: Very well.

A. Yes, there is unquestionably a difference in size, but not in character between these two.

XQ. 32. I am concentrating on the differences. You have already told us the similarities. And will you also agree with me that there is a difference in the number of the pyramids present in the two?

A. Yes, I brought that out in my former answer.

XQ. 33. No, you didn't.

[150-1] A. Yes, I will agree to that.

XQ. 34. And will you also agree with me that there is a difference in the size of the depressions in the two?

A. You are thinking now particularly of depth or of width?

XQ. 35. Let us take depth first.

A. I would say that the depressions in XXI are slightly deeper than those in CVIII.

XQ. 36. Will you also agree with me that there is a difference in the number of depressions for any particular unit of area?

A. Yes.

XQ. 37. Will you also agree with me——

A. There are more in XXI.

XQ. 37. Will you also agree with me that there is a difference in the width of the depressions?

A. Yes. Those in XXI are slightly wider.

XQ. 38. And will you agree with me that there is a difference in the uniformity per unit of area of the dispersion of the depressions?

A. No, I would be inclined to disagree with you.

XQ. 39. That is all. Thank you.

[152] MR. NEAVE: It is stipulated between the parties that if Mr. Kurtz were asked by what method of illumination these pictures were taken he would testify that they were taken by transmitted illumination. That is all for the plaintiff, your Honor.

THE COURT: You may proceed, Mr. Darby.

MR. NEAVE: The only additional exhibit, your Honor, I would like to offer, in view of Mr. Darby's statement that he is going to raise the question of the oath is the file history of the original application.

THE COURT: Do you have the file wrapper here?

MR. NEAVE: Not of the case of the patent in suit, your Honor, but the one which is the parent case, as it were. I offer in evidence certified copy of the file history of the Pipkin application, serial number 690672, February 4, 1924.

MR. DARBY: No objection.

(Received and marked Exhibit P-24 in evidence.)

MR. DARBY: That is the abandoned application, Mr. Neave?

MR. NEAVE: Yes.

MR. DARBY: I have no objection to that exhibit.

MR. DARBY: I offer in evidence to complete this story documentarily at least, an uncertified copy of the file wrapper and contents of the patent in suit and I know Mr. Neave does not object to its being uncertified. We have a certified copy here and being a photostat, white on black, it is easier to read for the court than our certified copy black on white.

(Received and marked Exhibit D-1, 1,637,510 file, wrapper Pipkin patent in suit.)

MR. DARBY: I offer in evidence the folder that I handed to your Honor in my opening statement containing the prior patent. Those patents comprise the Webb patent, 121,696; Archer 152,059; British patent 166,133 of 1921; Kennedy patent 733,972; Wood, patent number 1,240,398; Harrison patent 1,299,936.

(Received and marked Exhibit D-2.)

[155] MR. DARBY: I also offer in evidence the folio consisting of extracts of prior art literature referring to the issue consisting of Die Glashutte, volume XVII; Sprechsaal, volume 40; Tillotson article; Sprechsaal, volume 21; Sprechsaal, volume 22; Hohlbaum; and Sprechsaal, volume 45.

(Received and marked Exhibit D-3.)

MR. DARBY: Another thing which I have crusaded on is the elimination of a patent expert as such. I

think it is an insult to the intelligence of the court to have a witness on the stand and read a document that the court is quite capable of reading. I have no patent expert to present unless your Honor wants it, if so, I can produce it.

THE COURT: Patent experts are supposed to be of assistance, and of course my difficulty with patent experts is that invariably they are arrayed in conflict and ultimately confuse the court.

MR. DARBY: And they are biased; they have to be. If they do not testify the way their side wants them to they are not going to produce them as a witness and when it comes to construing a document the court can read it and there is nothing the patent expert can add to or subtract from it except perhaps in [156] a highly technical or mechanical or electrical case where real expert assistance is needed by the court. So with respect to these patents I could in a very few minutes' time point out the particular passages so that your Honor could mark them in your copy, which bear on the subject, and if we take the United States art first, the first one, the Webb patent, if your Honor will turn to page 2 of that patent beginning at the two last full clauses—this patent is so early in date that the lines are not numbered. I can perhaps point out in my copy where I have in mind.

THE COURT: You start reading. I will find it.

MR. DARBY: Right near the end of the first paragraph on page 2, "or the said articles may be placed upon a suitable frame and alternately submerging and elevating the same within the acid in the tank; or the articles may be placed over the tank and the acid poured upon them in intermittent streams."

The Archer patent, which is the next one, back in 1874 is where the drawings usually are. You will find

the statement, "Close the open ends or side of the Article to be ornamented, the inner surface of which being already provided with the desired design printed or painted in material capable [157] of resisting the action of the fumes of fluoric acid introduced as described in claim." I don't believe it is necessary to point the passage. I would ask your Honor to read the whole patent.

The next patent, the British patent, the part I call attention to is at page 2, beginning at line 14: "The 'satin-surface' to which reference has been made above"——

THE COURT: British patent, the second page, you say?

MR. DARBY: Yes, sir, page two.

THE COURT: Line 14?

MR. DARBY: Line 14.

MR. NEAVE: Mr. Darby, I haven't a copy of your book here, so I wish you would call them off.

MR. DARBY: British patent 166,133, page 2, line 4: "The 'satin-surface' to which reference has been made above may be given to the surface of plate glass by first heavily matting with an acid well known in the glass etching trade as 'white acid' and which consists of a mixture of hydrofluoric acid and an alkali such as carbonate of soda and water and subsequently reducing or clearing fully with hydrofluoric acid, thus producing a finely granulated and slightly diffusive surface, exhibiting a satin like [158] 'sheen' or like effect.

"A surface optically equivalent for the purpose and practice of this invention to the 'satin-surface' obtainable as above indicated may be obtained by first frosting heavily by sandblasting or grinding in accord-

ance with well known practice and subsequently 'reducing' or 'clearing' very fully with hydrofluoric acid, so that the original great diffusivity of the frosted surface is very markedly reduced."

We cite that, of course, as showing the inevitable rounding consequence.

The next patent is the Kennedy patent to which we have already called your Honor's attention and I ask that you mark for reference on page one, line 23, the first sentence, "The object and purpose of the present invention is to produce on the inner surface of the bulb a frosted appearance, which may cover the whole of the said inner surface or only a part thereof, as will be hereinafter explained."

And then on the next page, page 2, beginning at line 17—oh, I would like to read at line 7 on page 2: "This filling with water and emptying may be repeated to an extent sufficient to thoroughly cleanse the bulbs, after which they are removed and dried. [159] This process of washing is desirable, as it avoids the liability of water containing acid coming in contact with the exterior surface of the bulb."

We stress that because of the fact that we wash twice as taught by the Kennedy patent. Then beginning at line 18, "By 'acid' is here meant any liquid capable of producing the frosting or appearance called 'frosting' on the surface of the glass. Usually hydrofluoric acid or its compounds are employed for acting on or etching on glass, and this art is now well understood. My invention relates to a new method of effecting the frosting on the inner surfaces of the bulbs, globes, or the like, so as to leave the outer surface of the same smooth or polished as it comes from the glassblower." I emphasize this particular language: This art is now well understood, 1903.

And when I come to these technical publications, your Honor will see how clearly it was understood.

The next one is the Wood patent. Your Honor has already read this patent and I know that you have noticed the passage on the first page beginning at line 105; and in this connection I think I will also ask your Honor to read claim one of this early Wood patent: "The method of making a light diffusing screen, which consists in forming in a glass surface [160] a multiplicity of minute pits separated by a plane surface relatively wide as compared with the depth of the pits, then enlarging these pits into contiguous concave depressions, whereby each such depression forms a surface of a concave lens."

The Harrison patent, 1,299,936, shows a moulded glass, and I should also have called your Honor's attention to the language on page 2 of this Wood patent.

THE COURT: I think claim three is more—now there we are, you and I differ already. Claim three is more descriptive of the methods and the results. "Thereby enlarging said pits into contiguous concave depressions."

MR. DARBY: "And then removing the acid from said glass."

Then we come to the Harrison patent which as I say is a moulded product and if it is a fact that a product claim must be considered apart from the process which is produced, here is a glass structure used as a shade for a lamp as distinguished from a bulb for a lamp, where the inner surface is surrounded with round instead of sharp angular curvatures. The patent says: "The globe is formed by moulding into its surface rather small protuberances and [161] depressions, whereby each protuberance is more or less rounded and merges into the depression in a smooth and gradual manner."

THE COURT: No, I don't think that is pertinent.

MR. DARBY: Well, it shows a glass which is provided with rounded, as distinguished from sharp angular crevices. So much for that. We come to the publications taking first Die Glashutte.

THE CLERK: Exhibit D-3.

MR. DARBY: I call your Honor's attention to the passage on page 37. This article is entitled "Contributions to the knowledge of glass etching" and it states——

THE COURT: If there is a page 37 I have been cheated.

MR. DARBY: It is the first article.

THE COURT: Mine seems to stop at page 36.

MR. DARBY: Page 37 at the bottom of the page, your Honor.

THE COURT: I see, yes, all right.

MR. DARBY: This is the Glashutte article of 1887.

MR. NEAVE: All right.

MR. DARBY: 1887.

[162] THE COURT: There are two page numbers on the same page.

MR. DARBY: Yes; I failed to note that, sir. I am sorry. At the right-hand column, beginning approximately at line—let's take the left-hand column first; line 5, "Both gaseous hydrofluoric acid and a mixture of fluor spar and sulphuric acid as well as solutions of acid alkali fluorides can produce frosting under appropriate conditions, so that according to this it must appear probable that the process taking place in the

formation of the frosted surface is not the same in all these cases."

"In practice the need frequently arises to obtain the frost in several tones, in order to produce in this manner various effects. Owing to the particular kindness of Mr. Ed Kratzmann, manager of the Royal Hungarian State Glass Painting and Etching Factory in Pest, I have been able to become acquainted with the process applied in connection therewith, and I beg here again to express my thanks therefor. In order to obtain a tone as dark as possible in transmitted light one and the same place is frosted twice in succession. With one etching a somewhat brighter tone is produced, and for obtaining still brighter [163] tones the surface frosted once is 'clear-etched' with dilute aqueous fluoric acid once or several times (up to 9 times), the tones becoming thereby brighter and brighter," thereby constituting an instance of the prior art in which repeated etchings, up to nine times, is taught.

And then on page 40, at the bottom of the page, beginning in the right-hand column, line 67: "The grooves between the individual crystal etchings are very wide and divided into entirely trough-like depressed areas. This appearance is only produced by the free fluoric acid, which always widens all the grooves already present into trough-like forms. That this is so can easily be seen if a glass plate, which through use has acquired fine scratching, is etched with dilute fluoric acid and then examined under the microscope. It is then seen that all the scratched grooves have been converted into a chain of successive trough-like depressions, which have exactly the same appearance as the grooves in fig. 6 b b."

Somewhere in these papers the figure is given. Oh, here it is; at the very end of the article. I won't stop to go over that now.

Then beginning again at line 88:

[164] "Since, however, these troughs owing to their more rounded shape, cannot scatter the light so well as sharp-edged etchings, the frost must thereby turn out much finer and more translucent, and in this way the phenomenon is explained that the frost turns out the finer the more acid the bath, an observation already made by J. B. Miller. This phenomenon of itself leads me to the above mentioned so-called 'clear etching.' In this case an already finished frosting is subsequently treated once or repeatedly with diluted fluoric acid." So there is a clear, complete teaching as early as 1887, we contend, of rounding out the sharp angular surfaces.

And the next article is Sprechsaal, 1907, and the passage there that I ask your Honor to mark is in the right-hand column beginning at line 70: "The glasses which have been frosted in the manner above described are frequently subjected to another etching which proceeds further whereby their surface becomes more lustrous and receives a silk-like appearance. This finish is termed satin etching or silk matt. It is achieved by over-etching the frosted glass, after it has been cleaned from the coating in fluoric acid which is diluted with water [165] in the proportion 1:5, and indeed this over-etching can be repeated several times whereby the silk-like lustre is increased. After this over-etching the glass is washed in hot water, if it is over-etched several times the glass must be cleaned thoroughly each time, since otherwise it becomes spotty."

And there again is the two-step process for the purpose of increasing the lustre, rounding out, which in turn is effected by rounding out the crevices.

This next article, the Tillotson article, I urge upon your Honor to read in its entirety, because it shows photomicrographs of the glass after it has been subjected to one and more etchings, and those photomicrographs illustrate the rounded as distinguished from

the sharp angular crevices. Although I ask and urge your Honor to read the entire article, I call your attention particularly to the bottom of page 939 in the left-hand column:

"When an etched surface as shown in Fig. 5 is immersed in a solution of hydrofluoric acid, a similar action takes place. Figs. 9 to 11 illustrate such action for one-quarter, one-half and one minute immersion in a solution of equal parts of concentrated hydrofluoric acid and water. That this [166] result is a necessary consequence of uniform solution by the acid may be demonstrated geometrically. The first effect as shown in Fig. 9 is an enlarging and rounding out of the 'valleys', finally resulting as shown in Fig. 11 in a series of smooth 'saucer-like' depressions. This operation, which changes in so profound a way the character of the glass surface, is made evident to the naked eye only as a slight decrease in the opacity of the glass."

The next article is that of Sprechsall, 1906, number 21904. I won't take the time with that article.

The next one is 1910, Hohlbaum article, which is directed to the present-day manufacture of working up and ornamentation of finer hollow glass, and I will merely synopsisize that—as it is a comparatively short article, I will merely synopsisize that with the statement that again——

The Court: Well, it merely gives a series of formulæ for suggested baths.

Mr. Darby: That is right; that is right.

The Court: And it doesn't help very much in this.

Mr. Darby: It helps the defendants to this extent: it gives a clear exposition of etchings, washing, the necessity for washing, the value of using warm water [167] and double washing.

THE COURT: I don't think the plaintiff could seriously dispute that hydrofluoric baths were used for years for etching.

MR. DARBY: Also to enable your Honor to have everything before you that you may desire to refer to, inasmuch as Mr. Neave has offered in evidence the record in the same case, and in the Wabash case, I offer in evidence a copy of the minutes of the trial in the contempt proceeding in New York before Judge Galston for the same purpose that the exhibits were offered by opposing counsel.

THE CLERK: Exhibit D-4 in evidence.

MR. DARBY: I am ready for my first witness, your Honor.

THE COURT: You gentlemen didn't come to New Jersey to try all these cases before me, did you?

MR. DARBY: I hope not. We never can tell what effect prior adjudications are going to have. We know the doctrine of comity and——

THE COURT: All right, we will adjou. a until tomorrow morning at ten-thirty.

(Adjourned to 10:30 a. m. Thursday, September 25, 1941.)

[168] Newark, New Jersey,
Thursday, September 25, 1941.

(Case resumed pursuant to adjournment.)

(Appearances, as before stated.)

MR. DARBY: Your Honor will recall that Mr. Neave requested the right to reserve some additional testimony of Mr. Spencer in his prima facie case which we gladly consented to; he would like to complete his prima facie case before we proceed with our testimony.

MR. NEAVE: I would just like to ask Mr. Spencer a couple of questions to correct his testimony.

Mr. Spencer.

CHARLES DOUGLAS SPENCER, recalled on behalf of the plaintiff testified further as follows:

DIRECT EXAMINATION (Resumed).

By MR. NEAVE:

Q. 315. Mr. Spencer, on page 129 of the record on re-cross-examination you were asked the following questions and made the following answers:

"RXQ. 262. Didn't you just tell Mr. Neave that the etching solution that is given in the Pipkin patent is used by the General Electric?

[169] "A. I said had been used.

"RXQ. 263. Oh, had been used.

"A. Yes. Pardon me if I didn't make that clear. It was in the past tense.

"RXQ. 264. When was that used, Mr. Spencer?

"A. Oh, say 1912.

"RXQ. 265. And it has not been used since in commercial production?

"A. It was so much easier to use the frosting mixture that we have.

"RXQ. 266. Answer my question. It has not been used for the commercial production of anything so far as you know?

"A. I don't know. It may have been.

"RXQ. 267. You don't know of your own knowledge that it has been?

"A. No, I do not."

Do you want to make any comments or corrections in that testimony?

[170] A. I am not sure that it is perfectly plain what I meant or just what I was answering. Now, what I would say is this: that I do know that a frosting mixture of identically the same ingredients as that given in the Pipkin patent and of substantially exactly the concentrations there given was the outside, the standard outside, frosting mixture as used by the General Electric Company in 1920.

Q. 316. As well as in 1912?

A. Yes.

Q. 317. All right. Now, I show you Plaintiff's Exhibit 12——

MR. DARBY: 1920, was that?

MR. NEAVE: 1920, yes.

THE WITNESS: 1920.

Q. 317. —I show you Plaintiff's Exhibit 12 and ask you whether any of the lamps shown there were commercially satisfactory diffusing lamps.

A. No, they were not.

Q. 318. You testified that you had constructed some bulbs that were treated in accordance with specific frosting

and fortifying solutions given in the Pipkin patent. Did you examine the surface of the bulbs so treated?

A. I did, sir.

Q. 319. You examined them under the microscope?

[171] A. I examined them under the microscope.

Q. 320. What was the character of the surface?

A. The character of the surface is exactly as I have described for these other surfaces. They were characterized by the presence of these pyramidal areas surrounded by depressions with rounded bottoms.

Q. 321. By the "other surfaces," do you mean the General Electric and Jewel surfaces concerning which you have testified?

A. Yes.

MR. NEAVE: Cross-examine.

MR. DARBY: This is a continuation of the direct examination, so this will be a continuation of my original cross-examination.

CROSS-EXAMINATION.

By MR. DARBY:

XQ. 322. I take it from your testimony, Mr. Spencer, that you knew Mr. Pipkin, the patentee, personally?

A. Yes, sir, I do.

XQ. 323. Mr. Pipkin is still alive, isn't he?

A. He is.

XQ. 324. He is still employed by the General Electric Company?

A. Yes, sir.

MR. DARBY: That's all.

MR. NEAVE: That's all.

[172] THE COURT: But definitely.

MR. NEAVE: But definitely.

(Plaintiff rests.)

[173] GUSTAVE HERZBERG, called and sworn on behalf of the defendant, testified as follows:

DIRECT EXAMINATION.

By MR. DARBY:

Q. 1. Please state your age, residence and occupation, Mr. Herzberg.

A. I am 51 years old. I reside at 450 Richmond Avenue, Maplewood, New Jersey, and I am general manager of the Jewel Incandescent Lamp Company.

Q. 2. That is the defendant company in this action?

A. Yes, sir.

Q. 3. What technical training and education did you have, Mr. Herzberg?

A. Well, I am a graduate of New York University as a mechanical engineer.

Q. 4. And any other degree?

A. I am a Bachelor of Science and mechanical engineer.

Q. 5. What has been your experience in the incandescent lamp industry?

A. Immediately after I graduated from college in 1910 I was employed by the General Electric Company.

Q. In what capacity?

A. As a student and my first position was in the engineering department. I spent probably a year or a year and a half in the engineering department and then was transferred to the manufacturing division and was taught the various [174] operations in the manufacture of the incandescent lamp. Eventually I was placed in the Newark plant in which I went through various positions, until finally in 1918 I was made factory manager of the Harrison plant of the General Electric Company, manufacturing lamps. A couple of years later that plant was closed due to improvements in machinery which meant that they could get along with fewer plants, and I was in the home office for a num-

ber of years,—I think two years. I was chairman of the Piecework Committee and in charge of all factory publicity and in charge of foremanship training. Then I was transferred to Newark again as factory manager of the Newark plant where I remained until that plant was closed. Then I went back to the home office again doing the same kind of work until 1926 when I left their employ.

Q. 7. And was it shortly after that that you organized the present company, or its predecessor?

A. I went to work for about a year and then I finally went into manufacturing of lamps.

Q. 8. By the predecessor of the present company?

A. By the predecessor of the present company.

Q. 9. And about when was that?

A. That was about 1927, some time in 1927.

[175] Q. 10. And have you been continuously engaged in the manufacture of incandescent lamps since that time?

A. Yes, sir.

Q. 11. And what was the period of time that you were factory manager of the Harrison plant of the General Electric Company?

A. I should say about two years.

Q. 12. What years?

A. 1918 and '19, I believe it was.

Q. 13. And what years were you the factory manager of the Newark plant of the General Electric Company?

A. As closely as I can recall it was from about 1921 to 1923 or '4.

Q. 14. I show you Plaintiff's Exhibit 12. Were lamps of that character manufactured by you or under you while you were employed by the company?

A. Yes, sir.

Q. 15. All of them?

A. No, not all of them, but most of them, I should say.

Q. 16. Which ones, if any, were not manufactured while you were at the plant?

A. I don't recall this particular lamp here (indicating).

Q. 17. Pointing to No. 4?

A. No. 4, yes.

Q. 18. What type of lamps are these, Mr. Herzberg, from [176] your knowledge of the industry?

A. They were commonly known as decorative lamps.

Q. 19. Were they constructed with any problem of diffusion in mind?

A. No, sir.

THE COURT: That isn't true of all the lamps, is it?

THE WITNESS: Of all these lamps, yes, sir. Possibly—no, I should say all of them.

Q. 20. Now, will you explain why that is the fact? First, let me ask you this: Were any of these lamps manufactured prior to around 1924, to your knowledge?

A. Yes, sir.

Q. 21. Were any of them manufactured—were all of them manufactured prior to 1924, to your knowledge?

A. Yes, sir.

Q. 22. When did glare become a problem in the incandescent lamp manufacture, if it was a problem?

A. Well, it was no problem, I should say, even in 1924, except possibly on certain types. The efficiencies of the lamps manufactured in those days were very low, and there was really no need of any protection against the light because it didn't bother you. The larger types of lamps, which also were of low efficiency, are usually used above your head, we will say hanging from the ceiling in a factory; so even those lamps were not any problem as far as [177] glare was concerned. Then with the introduction of the gas-filled lamp——

Q. 23. About when?

A. I think that was about 1916 or '17—of course, the efficiencies were increased considerably, but we had a great

deal of difficulty in making gas-filled lamps of the smaller wattages.

Q. 24. And when you say "Lamps of the smaller wattages," you mean lamps such as are used in the home?

A. The ordinary house lamp.

Q. 25. Yes.

A. It was comparatively easy to make gas-filled lamps of the higher wattages which are used mainly in factories, for industrial purposes. And after a great deal of work by the engineering department, they gradually started to change one type after another, progressively downwards, and I believe by 1926 they had gotten down as far as the 50 watt. I don't recall when the 40 watt was finally made gas-filled, but it was some time after 1926; I don't know the exact date.

Q. 26. And until the lamps were of the so-called gas-filled type, was there any problem of glare in the ordinary home lamps?

A. No.

Q. 27. Do you know of your own knowledge what steps, [178] if any were taken by the General Electric Company in commercializing or inducing the public to use the inside frosted lamps, rather than the clear lamps?

A. Yes. I know definitely that the list prices were changed on lamps so that frosted lamps, inside frosted lamps, were five cents lower on the list price than clear lamps.

Q. 28. Of the same wattages?

A. Of the same wattages.

Q. 29. And did the General Electric Company continue to manufacture clear lamps of the same wattage as the inside frosted lamps?

A. Yes.

Q. 30. And do you know whether or not the General Electric Company today still manufactures lamps of the same wattage of the clear type as the inside frosted type?

A. Yes, they do.

Q. 31. Were you personally familiar with the initiation of the manufacture of inside frosted lamps by the General Electric Company as a commercial product?

A. I was, with the initiation of manufacture into the lamp factory.

Q. 32. Yes.

A. Not with the frosting of the bulb itself.

Q. 33. That is, the bulbs were supplied to you already frosted?

[179] A. That's right.

Q. 34. And was there any trouble with the lamps as to their life in storage?

A. The lamps?

Q. 35. Yes; after they were completely sold and distributed, did you have returns of those lamps?

A. Well, I know there were quite a number of complaints.

[180] MR. NEAVE: I object to that, your Honor. I don't see that he is qualified to tell about that. He was a factory man, manufacturing man and not a salesman.

MR. DARBY: I am not going to press that particular point because the witness has misunderstood my question.

By MR. DARBY:

Q. 36. Do you know whether or not the inside frosted lamps deteriorated in storage?

A. The bulbs as they were supplied to us from the Harrison bulb factory were allowed to stand in the factory usually for varying periods until we had to use them, and our instructions at that time were that any bulbs that stood around for three weeks or over had to be returned to the bulb factory for refortifying.

Q. 37. And why, if you know?

A. The bulbs became very brittle and were not suitable to use.

Q. 38. Do you know whether or not similar instructions applied to the completely fabricated lamps?

A. No, they did not.

Q. 39. Then as I understand you, when the bulbs received from the plant, supplied to you, the inside frosted bulbs lay in your factory for three weeks, before you fabricated completed lamps from them you were instructed [181-2] to return those bulbs for refortifying treatment, is that right?

A. That is correct.

Q. 40. Were you personally familiar with the fact that these bulbs did become weak?

A. Yes, definitely so.

Q. 41. Did you take part in devising the process used in frosting the bulbs employed by the Jewel Company in manufacturing the inside frosted lamps?

A. Yes, I did.

Q. 42. You are thoroughly familiar with the process and the equipment used?

A. Yes, I am.

Q. 43. Have you, at my request, prepared some photographs showing the commercial equipment employed by you in manufacturing your incandescent lamps?

A. Yes, I have.

Q. 44. Manufacturing the inside frosted bulbs for your incandescent lamps. Do you recognize this as the photograph?

A. Yes, I do.

Q. 45. Will you first give me a general procedural description of how the bulbs of your lamps are frosted?

A. The clear bulbs are placed in large trays similar to what you can see at the top of this machine here above these tanks and are placed in position, the end of the [183] machine farthest from us is the first position and you can

see some clear bulbs in that position; they are on a track which can be raised and lowered and after they are in position the track is lowered and these bulbs place themselves over nozzles which you can see just below the bulbs. The operator then opens a valve and injects three sprays of etching acid into the bulbs and then the elevator is raised and he pushes the tray down to the next position which is, I think you can see, the second position here where the bulbs look quite white. In the meantime, of course, he places another tray of clear bulbs in the first position; the track is lowered again and the bulbs in that second position come over the second tank which contains hot water, and they are injected with a spray of hot water, raised again, moved down to the third position which is the one nearest to us. In this position the bulbs are lowered again over the nozzles and cold water is injected into them. They are raised and pushed on to the heater which you can just see the beginnings of in the picture here which dries the bulbs.

Q. 46. That is, the heater is to the extreme left of the photograph?

A. That is right.

Q. 47. Is the etching operation in the first tank the [184] only etching operation to which the bulbs are subjected?

A. Absolutely.

Q. 48. I show you a second photograph and ask you if that correctly shows the trays lowered into position so that the open ends or the neck of the bulbs are positioned over the nozzle?

A. That is correct. That shows the trays in the lowered position.

MR. DARBY: I offer in evidence the first photograph referred to by the witness.

MR. NEAVE: No objection.

(Received and marked Exhibit D-5.)

MR. DARBY: I offer in evidence the second photograph referred to by the witness.

(Received and marked Exhibit D-6.)

Q. 49. Now I would like to go with you through this process in a little more detail. Referring to the first step I understood you to say that there are three squirts of etching fluid that are injected into the tubes in that position?

A. That is correct.

Q. 50. And in that respect this etching step of the process is comparable to the one which Mr. Spencer referred to yesterday where three or four squirts of etching fluid are injected into the tubes at that step; is that right?

A. I believe it is exactly the same.

[185] Q. 51. And do you agree with Mr. Spencer that the purpose of injecting three or four squirts of the etching fluid is to insure complete coverage and uniform coverage of the inside of the tube?

A. That's correct.

Q. 52. Now, how long are the tubes or bulbs in this etching step position?

A. Why, I should say that each of these three injections takes roughly four seconds. So they would be in there for about 12 to 15 seconds, from the time the tray is brought in until it is moved again.

Q. 53. And how long elapses between the time it moves from the etching step to the washing step, the first washing step?

A. Just perhaps a second; two seconds at the most.

Q. 54. Is the water used in this first washing step hot or cold?

A. It is compulsory to have that hot, in our operation.

Q. 55. It is hot?

A. Yes.

Q. 56. And how hot is it?

A. We try to maintain it at about 180 degrees Fahrenheit.

Q. 57. And do you take any steps to keep that water pure?

A. Yes. If you refer to any one of these photographs, you [186] can see—I am looking at the first one; in the second position in the front, you can see a pipe projecting in towards the tray of bulbs just below the bottom of the bulbs, and you can see a stream of water coming out of that. This is cold water which is continually running into that second position, pure cold water, directly from the faucet.

Q. 58. Is it pure cold water or pure hot water?

A. That's cold water.

Q. 59. That's cold water. And where is the heat effected?

A. In the bottom of the tanks we inject live steam which of course also brings some water into the solution.

Q. 60. And is there an overflow provided?

A. Yes.

Q. 61. For the tank?

A. If you look right in front here, there is a pipe running up from the floor and a sort of rod running up to the top of the machine. This is an automatic device—of course, you understand that the way the liquid is forced into the bulb up through these nozzles is by air pressure.

Q. 62. Air pressure on the top?

A. Injected into the tank.

Q. 63. Injected into the tank?

A. And in order to do that, we have to close all outlets while that injection is taking place. That's an automatic [187] valve which closes while the actual injection is taking place; but it opens immediately afterwards, and the liquid continues to flow down to the basement.

Q. 64. And that liquid that flows down to the basement is taken from the top surface of the tank?

A. Yes.

Q. 65. And approximately how deep is the water tank?

A. Oh, I should say approximately 10 inches.

Q. 66. And with reference to the pipes that extend up into the necks of the lamp bulbs, how deep do they extend into the tank?

A. We never keep the tank entirely full. It is probably only filled to about 8 inches, and the ends of these nozzles project about half way down that tank; about 5 inches into the tank.

Q. 67. And what happens to any acid that might be washed out of the tubes, the bulbs, from their inner surfaces?

A. That's carried off down this overflow to a reclaiming tank downstairs.

Q. 68. How many squirts of water are used in this washing operation at this stage?

A. That's controlled by the same valve that controls the first position, so it would be three also.

Q. 69. And how long do the bulbs remain in that position?

A. Exactly the same length of time as in the first position.

[188] Q. 70. Approximately 12——

A. Approximately 12 seconds.

Q. 71. 12 seconds. And what time elapses in the transfer of the tray of tubes from the second position to the third position?

A. About a second.

Q. 72. How long does the tray remain in the third position?

A. For the same time as in the first or second, because this is a continuous operation.

THE COURT: One valve controls all three operations, is that right?

THE WITNESS: Yes.

THE COURT: In other words, when you have a tray of bulbs being frosted, you have another tray being

washed with hot water, and a third tray being washed with cold.

THE WITNESS: That's exactly right. It is a continuous operation.

THE COURT: One valve runs the whole shooting match, is that right?

THE WITNESS: That's correct.

MR. DARBY: Thank you, your Honor.

Q. 73. And as I understand it, only cold water is used in the last washing operation?

[189] A. That's correct.

Q. 74. Now, have you described, completely described, your entire process of obtaining the frosted bulbs that you use for your inside frosted incandescent lamps?

A. Yes, sir.

Q. 75. Do you know of your own knowledge of any reasons other than to reduce glare that the inside frosted lamp bulbs were adopted by the General Electric Company?

A. Yes, we always had considerable difficulty in the factory due to the fact that during the assembly of the lamp, it was necessary for the operator to place the bulb over the mount—the mount is the part of the lamp holding the filament—and there was very little clearance between the neck of the bulb and the circumference of the filament, you might say, and very often the operators hit one or more of the anchors or the supports and bent them down. When we only sold clear bulbs, it was necessary to reject all these lamps because of the appearance; but with the introduction of frosted bulbs, of course, that could not be seen. This particular defect did not always interfere with the performance of the lamp, but it was unsightly. Of course, with frosted bulbs——

THE COURT: It was a commercial disadvantage.

THE WITNESS: That's correct.

A. (Continuing.) And the frosted bulbs covered it up and [190] we were able to reduce our rejections considerably with the introduction of frosted bulbs. In addition to that, of course, there was the question of the patent situation, which everybody knew about——

[191] MR. NEAVE: I object to that, your Honor.

THE COURT: I don't know what it is. You see, you know the answer; I don't know what the answer is.

MR. DARBY: That is the reason why he objects.

MR. NEAVE: I am objecting to the fact that he hasn't any qualifications to talk about the patent situation.

MR. DARBY: He can talk about what he knows; that is all I am asking.

THE COURT: I don't know, Counselor, what came to him as factory manager.

MR. NEAVE: It isn't responsive to the question, either.

THE COURT: I am sure it won't prejudice you in any way. I won't consider it binding on me that he is an expert in this field.

MR. NEAVE: Your Honor, I don't think it is going to prejudice us, and I don't have any objection other than that I don't think he is competent to talk about the patent situation.

THE COURT: I will take that into consideration in considering his answer. You have an advantage; this is your third dress rehearsal of this type of litigation. You know all the answers.

A. It was common knowledge that the Langmuir and some of [192] the other basic patents were expiring and that the company was very much interested in getting some other patents which would permit them to continue their control of the business; and this frosting patent, of course, looked like a heaven-sent opportunity to do just that.

MR. NEAVE: I think that is clearly objectionable, your Honor.

THE COURT: It may be stricken. I don't think it is material to this litigation.

Q. 76. Reference has been made in this case in the examination of some witness to a date of 1903; I personally think it was in connection with the Kennedy patent, and my recollection is that when you first went in the incandescent lamp industry it was subsequent to that date?

A. That was in 1910.

Q. 77. 1910. As late as 1910 was there any problem of glare in incandescent lighting?

A. No.

MR. DARBY: Mr. Neave, do you have available or have you any objection to my using your bump test?

MR. NEAVE: No, not at all.

MR. DARBY: While they are doing that I can ask one or two more questions.

By MR. DARBY:

Q. 78. How long has the Jewel Company used the process [193] that you have described in the manufacture of inside frosted lamps?

A. Since about 1932 or '33, I believe.

Q. 79. Have you ever used a process for producing inside frosted lamp bulbs which utilized two etching operations?

A. No.

Q. 80. What is the frosting solution used by Jewel in the manufacture of its lamps?

A. I have it with me here. My memory isn't too good on that. It consists of about 33 per cent. by weight of hydrofluoric acid; 25 per cent. by weight of ammonium bifluoride; 12 per cent. of ammonium carbonate; 15 per cent. soda ash and 15 per cent. water.

Q. 81. Did a patent issue to you and your collaborator in the devising of the process that you use in your commercial operations?

A. Yes.

THE COURT: Open season on this type of patents; everybody has them.

MR. DARBY: Yes, sir.

Q. 82. Is the patent that issued to you and Mr. Ambrunn, number 2,025,588, granted December 24, 1935 on an application filed August 2, 1933, the patent that you refer to?

A. Yes.

[194] MR. DARBY: I offer the patent in evidence.

(Received and marked Exhibit D-7.)

MR. DARBY: Will you proceed to heat up some water.

Q. 83. With reference to the trouble you had with inside frosted bulbs becoming weak when in storage, when was that?

A. I should judge around 1924 just about the time that we first introduced the frosted bulbs.

Q. 84. And how long did that remain the instruction?

A. Well, it was the instruction as long as I was at the Newark plant.

Q. 85. You left the Newark plant when?

A. I should about 1924 or 1925, and what happened immediately after that I don't know.

Q. 86. How weak did the bulbs get?

A. Well, they could not be used. You could not make them into lamps without their breaking.

Q. 87. They were too weak for handling?

A. That is correct.

Q. 88. In normal fabrication. Were you familiar with the process used by the General Electric Company in the production of inside frosted lamps at that time?

A. The bulbs or the lamps?

Q. 89. The bulbs, the frosting of the bulbs?

A. Yes, in a general way.

[195] Q. 90. Do you know how to make either a strong bulb frosted on the inside or a weak bulb frosted on the inside?

A. Yes, sir.

Q. 91. By substantially the same etching operation, using only the same etching operation?

A. Yes, sir.

MR. DARBY: Your Honor, I want to demonstrate two things in open court room. I want to demonstrate a virtual reproduction of the defendants' commercial process of producing a strong frosted lamp, inside frosted lamp, using its own etching solution, and then by doing exactly the same thing, make the lamp crack, subject it to the bumping ~~heat~~ test, to show your Honor that whether the lamp is strong or weak has nothing whatever to do with Pipkin's invention. And this demonstration will be made under the direction of Mr. Herzberg, so he can be subjected to any cross-examination in connection with it.

Q. 92. And what I ask that first be done, is to subject—I will ask you first to produce several clear bulbs, such as are used by the Jewel Company in the fabrication of its inside frosted lamp bulbs.

A. (Bulbs produced.)

Q. 93. Now, will you subject this bulb to a bump test, [196] so as to get the strength of the clear bulb? And I suggest, Mr. Demonstrator, that you subject it to the bump test in gradations of 5.

MR. AMBRUNN (the demonstrator): I don't think the Court can see the gradations.

Q. 94. Can you see the gradations?

MR. AMBRUNN: I can see the gradations.

MR. DARBY: Well, squat down so the Judge can see over your head, and if you can see the gradations, that's all that is necessary. Give it 5. You had better hold your hands over to the other side.

(The operator complied, using a bump tester which he produced.)

MR. DARBY: 10; 15, so far. Now 20; now 25; 30; 35 next; 40; 45; 50.

(Mr. Ambrunn operated the bump tester as directed.)

MR. DARBY: Note on the record that the clear bulb does not shatter at 50, which is the highest gradation on the bump test.

Now, have you got your water pump?

MR. AMBRUNN: Yes, sir.

MR. DARBY: I have asked you to heat some water at the temperature to which the water is heated in your hot water washing. Is it at that temperature?

[197] MR. AMBRUNN: Not yet.

MR. DARBY: While that is heating, will you now produce a small commercial inside frosted bulb, and subject it to the bump test, in the 5 gradations?

5; 10; no shattering; 15; no shattering; 20; 25; no shattering; 30; 35; 40; 45.

(Mr. Ambrunn operated the bump tester as directed. At the 45 test the lamp fell from the holder.)

MR. DARBY: And finally the 50.

(At the 50 test the lamp again fell from the holder to the floor.)

THE COURT: That's better than 50.

MR. DARBY: It is noted that the——

THE COURT: You didn't kick it when it was down, did you?

MR. AMBRUNN: No, your Honor.

MR. DARBY: It is noted that the inside frosted commercial bulb of the Jewel did not shatter at 50, the maximum gradation of the bump test.

Q. 95. Now, Mr. Herzberg, was that bulb frosted strictly in accordance with your commercial process, as you have described it from the witness stand?

A. Yes, sir.

MR. DARBY: Is the water hot enough yet?

MR. AMBRUNN: Yes, sir.

[198] MR. DARBY: Now, will you please take one of the clear bulbs and subject it to, let's see,—in simulation of the defendants' process, will you pour in the etching fluid and pour it out three times—in simulation of the three squirts and then——

THE COURT: That's going to be difficult.

MR. DARBY: No, I think he can do it.

(Mr. Ambrunn poured the etching fluid as directed.)

MR. DARBY: Now, will you wash it with the hot water, with three squirts?

(Mr. Ambrunn washed as directed.)

MR. AMBRUNN: I will spill this in the pail here so it doesn't get mixed up.

THE COURT: You just do it; don't tell us about it.

[199] MR. DARBY: Throwing the waste in the empty pail. Wash it three times, just like you do in your own operations, three squirts; now in the cold water, three washings with the cold water. Although we haven't got the necessary drying facilities here, will you now subject that bulb to the bump test. All right, go ahead. 5; 10; 15; 20; 25.

(Bulb breaks.) She broke at 25. But I would like to call the attention of the court to the fact that the breakage occurred at the neck rather than in the bulbular portion and although the bulb fell on the floor it did not break. Now will you take another clear bulb?

By MR. DARBY:

Q. 96. Mr. Herzberg, can you offer any explanation as to why this bulb broke at the neck at 25?

A. Yes, the bulbs, you know, are blown automatically on a machine and there is usually quite a variation in the thickness of the glass so that the chances are that that particular bulb may have been weak at the neck due to variation in the wall thickness.

MR. NEAVE: Are you preserving that bulb?

MR. DARBY: Yes, I would be glad to give it to you.

Q. 97. Did you notice whether or not the etching [200] fluid went completely to the top?

A. I don't believe we got it all the way to the top.

THE COURT: Let us put a sticker on the bulb and mark it as an exhibit.

MR. DARBY: You had better wash the outside of it so you won't get acid from it.

MR. HERZBERG: Wash it in more cold water.

MR. DARBY: Let it dry and I will offer that bulb in evidence.

(Received and marked Exhibit D-8.)

MR. DARBY: Have you got your water hot? I am going to ask you to repeat that with another clear bulb. Start your water up so that you can get it up to that temperature again.

By MR. DARBY:

Q. 98. Now, Mr. Herzberg, you say you know how to make the bulb weak using exactly the same etching fluid? How do you do that?

A. We fill it three times with same etching solution we have here but instead of washing it with the hot water, you just wash it with cold water.

MR. DARBY: All right. Now will you please demonstrate that. Make the first part of your operation as nearly identical with the first part of your prior operation as is possible. Leave the same [201] amount in as you did before. Give it three washes like you did before. Now subject it to the bump test.

First, 5.

MR. DARBY: It smashed at 5 on the bump test. Now will you please take another of the clear glass bulbs, test your hot water for proper temperature as well as the frosting solution for proper temperature and amount. This time I wish you would take particular pains to see that the frosting solution comes all the way to the top of the clear bulb.

MR. AMBRUNN: That is what I was trying to avoid, if it overflows.

MR. DARBY: Are you ready? Have you enough of the etching fluid to fill it right up to the top?

MR. AMBRUNN: Yes, sir.

THE WITNESS: Try to get some of the hot water around the neck when you rinse it.

MR. DARBY: Now, will you, having completed the operation on another clear bulb, will you now subject it to the bump test. First, at 5; then 10; 15; 20; 25; 30; 35; 40; 45. It broke at forty-five. Thank you, Mr. Ambrunn and you may cross-examine. Just a minute; I will offer in evidence the fragment of the bulb which broke at 5.

(Received and marked Exhibit D-9.)

[202] MR. DARBY: And I will offer in evidence the fragment of the bulb which shattered at 45.

(Received and marked Exhibit D-10.)

MR. DARBY: And I will ask Mr. Herzberg to resume the stand.

[203] Q. 99. In your commercial operation, Mr. Herzberg, have you made the same experiments by taking the bulb off of the etching position, omitting the hot water washing, and giving it only the cold water washing?

A. Yes.

Q. 100. And how does that compare in your commercial operations with the crude duplication of your commercial operations attempted in the court-room?

A. They were very weak.

Q. 101. The bulbs were just equivalently as weak?

A. Yes.

MR. DARBY: You may cross-examine.

CROSS-EXAMINATION.

By MR. NEAVE:

XQ. 102. Mr. Herzberg, you said that you were at the home office in 1920, 1922. What do you mean by that?

A. Well, the home office was in Harrison, of the Edison Lamp Division, I should have said, of the General Electric Company; the home office——

XQ. 103. Was that the home office of the——

A. No. That was the Administrative Department.

XQ. 103. What did you do there?

A. I was chairman of the Piece Work Committee, had charge of all factory publicity, had charge of foremanship training; I was engaged in writing up a complete index of all [204] the operations concerned with lamp making, to be used in educational work, and so on.

XQ. 104. When you were manager—Are you through?

A. Yes.

XQ. 104. When you were manager of the Harrison plant, which I believe was in 1918, was there any outside frosting being done in that plant?

A. Yes.

XQ. 105. And you were familiar with how outside frosted lamps were made?

A. Yes.

XQ. 106. When you became manager of the Newark factory, in 1921 to 1924, was there any outside frosting being done then?

A. Yes.

XQ. 107. You were familiar with that?

A. Yes.

XQ. 108. Was there any inside frosting being done at that time?

A. No. Just towards the end of that period there was; I mean we didn't do it, of course.

XQ. 109. Towards the end of the period when you were in the factory?

A. In the Newark factory, yes.

XQ. 110. And can you give me the exact date when you [205] left?

A. When I left the General Electric Company?

XQ. 111. When you left the Newark factory.

A. I don't recall the exact date. I think it was in 1925.

XQ. 112. Was it in 1925?

A. Sometime.

XQ. 113. It was in 1923?

A. Yes.

XQ. 114. Were the lamps inside frosted at the Newark factory?

A. No.

XQ. 115. Where were they inside frosted at that time, in 1925?

A. At the Harrison bulb factory.

XQ. 116. Did you ever go into the Harrison bulb factory?

A. Yes, very often.

XQ. 117. When was that?

Since 1925, I mean.

A. After the Newark plant was closed, as I said before, I was transferred back to the home office, and in connection with the setting of piecework rates for all of our plants, including the bulb works, it was necessary for me to go over to the bulb works quite often, and of course I became familiar with all the operations there.

XQ. 118. Including the inside frosting operations?

[206] A. That's right.

XQ. 119. So that you were familiar with the machinery there used, and the solutions that were there used?

A. Well, I wouldn't say I was familiar with the solutions.

XQ. 120. You were generally familiar with them?

A. Generally familiar with them.

XQ. 121. Now, you referred to a predecessor of the present company. What was that predecessor?

A. That was Jewel Lamps, Inc.

XQ. 122. What was their address?

A. 226 Halsey Street, Newark, New Jersey.

XQ. 123. How long were they there?

A. I think from 1927 to 1933; I am not quite sure of the dates.

XQ. 124. What is the present address?

A. The present address?

XQ. 125. Yes.

A. 900 Passaic Avenue, East Newark.

XQ. 126. Do you frost your own bulbs now?

A. Yes,—not the Jewel Company; we have a subsidiary company which does that.

XQ. 127. What is the name of the subsidiary company?

A. Modern Products.

XQ. 128. And were your bulbs frosted by the Modern Products in 1935 and 1936?

[207] A. Yes. Not—Now, I will recall that. I believe the name of the company was changed within the last year or two. It was Industrial Products before then.

XQ. 129. I see. But it was a subsidiary of Jewel's?

A. That's right.

XQ. 130. Are you familiar with the way in which your bulbs were frosted by that company in 1935 and '36?

A. Yes.

XQ. 131. And was it by the method that you have described, referring to the two photographs, defendants' Exhibits 5 and 6?

A. Yes.

XQ. 132. Who is in charge of those frosting operations of that company?

A. Mr. Ambrunn.

XQ. 133. I beg your pardon?

A. Mr. Ambrunn.

XQ. 134. And was he in charge in 1935 and '36?

A. Yes.

XQ. 135. He is the co-patentee with you in your patent No. 2,025,588?

A. That's correct.

XQ. 136. Was Mr. Ambrunn ever an employee of the General Electric Company?

A. Yes.

[208] XQ. 137. Where?

A. In the Harrison bulb works.

XQ. 138. What was his job there?

A. He was a mechanic.

XQ. 139. What did he do as a mechanic?

A. A machinist.

XQ. 140. In what portion of the bulb works did he work?

A. I believe up in the bulb blowing department.

THE COURT: Well, is Mr. Ambrunn available?

THE WITNESS: He is the assistant who just performed these demonstrations.

MR. DARBY: He is the man who just performed these demonstrations.

XQ. 141. Do you know whether Mr. Ambrunn worked in the frosting department at the General Electric Company?

A. I believe he did. I am not entirely familiar with what his work was there.

XQ. 142. Do you know when he left them?

A. When he left them?

XQ. 142. Yes.

A. I really don't recall. I don't know.

XQ. 143. Well, was it after 1930?

A. I don't believe so. I think it was before.

XQ. 144. It was before 1935, before October?

A. Yes, it was before 1935.

[209] THE COURT: The difficulty, Mr. Neave, is that here Mr. Ambrunn sits in the court-room, and we ask a man who is relying somewhat on hearsay.

MR. NEAVE: Well, this is enough.

THE COURT: There he sits, very comfortably.

MR. NEAVE: Mr. Darby hasn't offered to ask him these questions, or have me ask him.

THE COURT: Well, you are free to call him.

MR. DARBY: You are free to call him.

MR. NEAVE: Well, if it is necessary, we will.

THE COURT: His own testimony, I assure you would be much more impressive.

XQ. 145-146. I show you Plaintiff's exhibit 12 and ask you whether you know whether any of the lamps shown in that exhibit are now manufactured.

A. I would say that it is difficult to see just what this is, whether it is a frosted or a white lamp, or what it is. No. 10, I am referring to.

XQ. 147. That was testified to by Mr. Spencer; Mr. Spencer testified that that was an outside coated lamp, like a painted lamp, white paint.

A. I believe lamps like that are manufactured today by some of the lamp manufacturers.

XQ. 148. Do you know by whom?

A. And types quite similar to some of these others are [210] still manufactured.

XQ. 149. By whom?

A. For instance, No. 6 here; that's used extensively in candelabras or wall fixtures, a lamp very similar to that, to this day.

XQ. 150. Like a flame lamp, you mean?

A. That's right.

XQ. 151. Yes. Do you make any of those?

A. Yes.

[211] XQ. 152. Do you make any of the coated lamps?

A. Yes.

XQ. 153. White coated lamps?

A. Yes.

XQ. 154. For what purpose are they used?

A. Oh, for ordinary use we coat them on the inside, not the outside. Of course there are some coated on the outside.

XQ. 155. Do you make any of the opal lamps?

A. Not of opal glass, no.

XQ. 156. Have you any personal knowledge of the maximum brightness of clear lamps in 1920, let us say, in figures, I mean?

A. No, I don't.

XQ. 157. I understood you to say that outside frosted lamps, and lamps having some sort of a diffusive envelope were used principally for decorative purposes. Did you testify to that effect?

A. I don't recall testifying to that effect, but I believe it is so.

XQ. 158. That was my recollection of your testimony, prior to 1924, that they were used. Now what do you mean by decorative? You used the word "decorative," what do you mean by that?

A. Well, in the ordinary home the clear lamp has a raw appearance, and the average woman doesn't like it and [212] she likes some kind of a covering over it to enhance the appearance of the room and frosting served that purpose. It blended usually with the colors in the room better than a clear bulb did.

XQ. 159. What do you mean by raw appearance?

A. Well, I mean that it is an unfinished appearance of a clear bulb; it is not a smooth finished appearance of a clear bulb.

THE COURT: The filaments are unsightly?

XQ. 160. Is that what you mean, unsightly?

A. It was unsightly, rather than raw. I think that is the correct word.

XQ. 161. Now referring to the photographs, defendants' exhibits 5 and 6, turning to defendants' exhibit 5, can you tell me the cubical contents of the container where you

give the second treatment to the lamps, where they are treated with hot water?

A. Well, I don't know it off hand. As I say that is about ten inches deep but only full to about an eight inch level. It is perhaps eighteen inches wide and three feet long, roughly. I think the cubical contents could be figured from that. All three tanks are exactly the same, all three positions.

XQ. 162. What is the rate of flow issuing out of that [213] tank of the clean water that you said flowed into it?

A. It varies based on the speed of the machine and the type of bulb we are using, but I would say on the average we have found it should be about four pounds per thousand bulbs, of water.

XQ. 163. Four pounds per thousand bulbs, of water. Now, what is your rate of production? Can you translate that into time for me?

A. A thousand bulbs would take us perhaps five minutes. You can figure it, the cycle takes about fifteen seconds on a tray, 81 bulbs in each tray, so it would be the number of times 81 goes into a thousand times the 15 seconds.

XQ. 164. Now tell me why do you vary the amount of water that goes into that tank with the different kind of bulb treated?

A. There is a certain amount of water carried over by the bulbs into the third position, and if we didn't add water in that position the tank would eventually be dry so that we have to add water to it.

XQ. 165. To the second position?

A. Yes.

XQ. 166. Now, what happens to the solution that leaves that second tank?

A. It goes down to the reclaiming department in the basement where it goes into tanks and is eventually reclaimed, [214] the ammonium bifluoride.

XQ. 167. What do you do with that then?

A. That is used over again in the etching solution.

XQ. 168. In the first operation?

A. That is correct.

XQ. 169. Now, I don't quite understand why you vary the amount of water that flows into the second tank, depending upon the difference in the bulbs. That wasn't made quite clear to me in your previous answer.

A. Well, there is a certain amount of liquid that is carried over by the bulbs into the next position which adheres to the sides of the bulbs.

XQ. 170. You mean it is only varied because if you have a larger bulb it carries over more liquid into the third position?

A. Yes, there is more surface. Then in addition to that there is another reason, that is that we want to keep that as near one hundred percent water as we can, and it is necessary to add water to it or else it eventually becomes thickened up. After all it does carry out some of the by-products of the frosting from the first position; I mean the silicate perhaps—I don't know just what the chemical solutions are, but there are some that are carried out there and we don't want this to thicken up; we want to wash it.

[215] XQ. 171. As I understand it as the bulbs are moved over from the first to the second position the acid etching solution that is on the inside of the bulb drips down into the second tank and then the bulbs are treated by the solution in the second tank, is that right?

A. They are washed down by that solution.

XQ. 172. That's right. And that goes into that second tank?

A. Well, most of it is carried off immediately by the overflow.

XQ. 173. But it goes into the tank?

A. Yes.

XQ. 174. Have you ever made an analysis, or have you ever had an analysis made of the solution in the second tank?

A. No.

XQ. 175. I think you testified that the inside frosted lamp obscured any filament defects that there might be in the lamp?

A. That is correct.

XQ. 176. The outside frosted bulb would do that, too, wouldn't it?

A. Yes.

THE COURT: Of course, the outside frosted bulb, regardless of the filament, would still retain its disadvantages of becoming dirty?

[216] MR. NEAVE: Yes, but I didn't think I had to go into that.

XQ. 177. I believe you testified that you knew how to make a strong or a weak inside frosted bulb using the same etching solution?

A. Yes.

XQ. 178. Did you know that prior to 1923?

A. Prior to 1923?

XQ. 179. Yes.

A. No.

XQ. 180. Now, on the demonstration that we had here there was first the clear bulb that was tested on the bump tester; is that clear bulb the same as the clear bulbs that are used in your lamps?

A. Yes.

XQ. 181. Where does that come from, do you know?

A. Corning Glass Works.

XQ. 182. Am I correct in understanding that the ingredients in the frosting solution that was used on this test are the same as you gave to Mr. Darby in your direct examination as the ingredients you use in your commercial process?

A. With a slight variation, perhaps, of course, but those figures were approximate; we tried to keep as close to them as possible.

XQ. 183. What was the variation in this particular [217] solution?

A. I don't believe there was any variation; none that I know of.

XQ. 184. Where did this solution come from?

A. Right from the tank this morning from the factory.

XQ. 185. From your ordinary commercial run?

A. That is right.

XQ. 186. Your patent 2,025,588 gives a formula for frosting; is that the same formula as you stated was used by you?

A. Yes, except that I believe there is an error in this patent in that it says a ten percent solution of hydrofluoric; I don't know just what they meant by that. Now that I examine that closely, I think that should be 60 percent instead of ten percent.

XQ. 187. And that is what you use?

A. That is what we use.

XQ. 188. Are there any other errors in that patent?

A. No. Everything else is correct, I think.

XQ. 189. When did you say that you went with the Jewel Company? Was it in 1928?

A. With the Jewel, about '27, I think, when I started with the original Jewel Company.

XQ. 190. And prior to that time you didn't know how to make an inside frosted bulb weak or strong at will?

[218] A. Well, I knew in a general way from observation in the bulb factory.

XQ. 191. The bulb factory at General Electric Company?

A. At Harrison, that is right.

XQ. 192. But you did not know that prior to your observation of the process in the General Electric Company's Harrison factory?

A. That is right. It never had been any problem. I was just interested.

RE-DIRECT EXAMINATION.

MR. DARBY: I think it appears on the record but in view of the cross-examination I will make sure of it.

By MR. DARBY:

RDQ. 193. The hot water that was used in the court's demonstration today was pure hot water, was it not, Mr. Herzberg?

A. That is right, it was taken right from the court room.

[219] RDQ. 195. Now, in your commercial operations, when you first start your machine in operation with plain water, with no acid present possible, from prior operations, are the first batch of bulbs tested run right through your commercial run?

A. Yes.

RDQ. 196. They are your commercial products?

A. That's right.

RDQ. 197. As well as the last batch of bulbs?

A. That's right.

RDQ. 198. Have you ever taken any water from the hot water tank and poured it into any of your clear bulbs to see what effect, if any, it would have on the clear bulbs?

A. Yes.

RDQ. 199. What effect did it have on them?

A. No effect at all. The bulbs remained just as clear as before.

RDQ. 200. And what conclusion do you draw from that as to the presence or absence of any etching solution in your tank?

A. There can be practically none present, otherwise it would etch the surface of the glass.

RDQ. 201. As a matter of fact, state whether or not your entire set-up as to the second tank, your hot water [220] tank is for the purpose of avoiding the presence of any etching fluid in there?

A. We are very careful about that.

RDQ. 202. State whether or not it is for the purpose, of avoiding——

A. It is absolutely for that purpose.

MR. DARBY: Might I call your Honor's attention to one thing before I conclude with this witness?

The Pipkin patent, in translating this bump test, I feel sure your Honor has it in mind, states on page 2, line 45, that a bulb having a strength less than 7, that's 7 on the bump test, is not commercial. Both of the claims cover, translated to layman's language, any bulb which has a strength greater than 7 on the bulb test—between 7 and 8; mathematically, it is between 7 and 8—20 percent.

That's all with this witness.

MR. NEAVE: Just one more question.

RE-CROSS-EXAMINATION.

By MR. NEAVE:

RXQ. 203. Mr. Herzberg, I show you a small sleeve which is in evidence, Plaintiff's Exhibit 17. I note that the portion of the sleeve to which I am referring is obscured in Plaintiff's Exhibit 17 but is seen in Plaintiff's Exhibit 18. I notice on the sleeve it says, [221] "Licensed under the following U. S. Patents," and then gives a series of six patent numbers. Can you tell me whether the first number refers to a design patent or a mechanical patent?

A. No, I——

MR. DARBY: I object, if the Court please. I don't think that is relevant or material. Certainly it is not cross-examination.

THE COURT: Well, we have tried several things here this morning that looked to me as though preparations were being made for the next suit, and not relating to this patent.

MR. DARBY: I would hate to have Mr. Neave make preparations for my next suit because he has asked me

about the patents of my client; and I don't think that that's relevant or material.

MR. NEAVE: Well, your Honor, my purpose in this is that I think everybody, including the General Electric Company, has a right to know what these patents are that are listed on the sleeve as a notice.

MR. DARBY: Well, ask us and we will tell you, but I don't think it is proper to ask the witness.

THE COURT: Well, of course, the difficulty is, my only objection is I don't like to be the sounding board for this, you see.

[222] MR. NEAVE: All right, I withdraw the question.

THE COURT: If it is material to this issue, I will hear it.

MR. NEAVE: I will withdraw the question. That's all, Mr. Herzberg.

MR. DARBY: That's all. Thank you, Mr. Herzberg.

THE COURT: But fishing expeditions sooner or later become obvious—even to a Judge, you know.

ROY M. ALLEN, called and sworn for the defendant, testified as follows:

DIRECT EXAMINATION.

By MR. DARBY:

THE COURT: Suppose, before we hear this witness, we take about five minutes out.

(Following a short recess at this point the trial was resumed as follows:)

Q. 1. Please state your age, residence and occupation.

A. I am 59 years old. I reside in Bloomfield, New Jersey. I am a consulting scientist, specializing in metallurgy and microscopical sciences.

Q. 2. Will you please state your education, training, and experience, which qualifies you to testify as an expert in the matter of the examination and translation of photomicrographs of etched glass surfaces?

A. I had my school courses, chemistry, physics, and the [223] other sciences, which gave me the start in the work which I picked out to do, and I started in microscopical work while I was still in high school, as a matter of fact, and had my private laboratory. I bought my first microscope in 1898 and took my first photomicrograph the following year, and have maintained my own laboratory almost continuously ever since. I was for sixteen years in the Research Laboratories of the Bell System at 463 West Street, New York, in various supervisory capacities, and I left there in 1925 to engage in private consulting work, and I have been in that ever since. The most of my microscopical training, of course, has been apart from that which I derived in school because, as a matter of fact, even today very few of the higher institutions of learning even have a course which goes very far in microscopic sciences. [224] Q. 3. And do you belong to any technical societies?

A. Yes, I am a member of various societies. I am a Fellow and past-president of the New York Microscopical Society; a member of the New York Academy of Science and American Microscopical Society; American Institute of Mining and Metallurgical Engineers; and of various other technical societies.

Q. 4. And have you written any books or technical articles on this line of work?

A. Yes, I am the author of several books on various aspects of photomicrography. One of my books is put out by Van Nostrand on the microscope; a second one on photomicrography is in press now. I am a licensed professional engineer from New York State and listed in Who's Who in engineering.

Q. 5. And has your work included extensive microscopic examination of etched glass surfaces?

A. It has included a considerable amount of work on glass as well as on practically all materials of construction.

Q. 6. And did you testify as an expert in behalf of the Wabash Company in the case of General Electric vs. Wabash on the contempt proceedings?

A. Yes.

Q. 7. Are you familiar with the Pipkin patent?

A. Yes, sir.

Q. 8. Were you instructed, in preparation for your [225] testimony in this case, to acquire some General Electric lamps, commercial lamps, and some of the commercial Jewel structures?

A. Yes, sir.

Q. 9. For the purpose of making photomicrographs of the interior surfaces thereof?

A. Yes, sir.

Q. 10. And did you make microscopic examination and photomicrographic prints as a result of your examination of those lamps?

A. I did. I secured the General Electric lamp on the outside market. I did not secure a finished lamp of the Jewel, but instead I went to their plant and observed the process of manufacture, the etching, and took my own samples right from the etching machine.

Q. 11. Right out of the commercial line?

A. Yes, sir.

Q. 12. Now, will you please produce the photomicrographs that you made in accordance therewith, identifying them as you produce them, so that I may offer them in evidence, before we go into a description of what they show?

A. My examination of the General Electric etch while it superficially revealed similar characteristics to that which I have previously studied, of which I had made a very extensive examination—(Interrupted)

[226] Q. 13. In the Wabash case?

A. In the Wabash case. I felt justified to use in showing the structures of the General Electric the photomicro-

graphs which I had prepared for the Wabash case, particularly as I was very much pressed for time. The one that I am offering, therefore, in that instance, is the one which I had used previously.

Q. 14. These photographs that you hand me are the photomicrographs that you made of the General Electric lamp at the time of the Wabash litigation?

A. Yes.

MR. DARBY: I offer in evidence——

A. (Continuing.) I might say that these larger ones bear no marking at all. Therefore it will have to be supplied.

[227] MR. DARBY: I offer in evidence the photomicrograph of the inside surface of the General Electric lamp.

THE CLERK: Any objection, Mr. Neave?

MR. NEAVE: No objection.

THE CLERK: D-11 in evidence.

Q. 15. Have you examined the photomicrographs of the General Electric lamp in evidence in this case, offered by the plaintiff, as Plaintiff's Exhibit 16?

A. That, as I understand it, is the book of three——?

Q. 16. That's right.

A. I have.

Q. 17. Are there any material differences between your photomicrographs and the photomicrographs of the General Electric lamps offered by the plaintiff in this case?

A. Yes, there are some differences.

Q. 18. But are there any material differences, or substantial differences?

A. I would not class them as substantial, but they are different; and furthermore, my examination of the latest sample which I have secured of the General Electric on the open market bears out the pictures as Mr. Spencer has re-

vealed them, and also the differences between the present and the one which I took.

Q. 19. Then you have no reason to dispute the accuracy [228] of the photomicrographs offered by the plaintiff and contained in Plaintiff's Exhibit 16 as being representative of the current commercial products of the General Electric Company, is that right?

A. I would qualify that by saying that I agree in so far as the pictures taken by reflected or incident light is concerned. I do not believe that the pictures taken by transmitted light are correct interpretations.

Q. 20. All right. Then so far as the reflected pictures are concerned, you accept them as correctly illustrating the current production of General Electric inside frosted lamps?

A. Yes, sir.

Q. 21. What is the next set of photographs? State what they are.

A. I have here a photomicrograph of the defendants' lamp, one of the ones which I secured at the plant. I might say that the magnifications of the General Electric and this one are identical; that is they are 1,000 diameters enlarged.

MR. DARBY: I offer this photograph as defendants' Exhibit 12.

THE CLERK: D-12.

Q. 22. What is the next group of photographs?

A. I also had Mr. Ambrunn make for me while I was taking [229] the standard commercial samples, a special bulb which was etched in the regular way, which I removed and had him wash in water, and I have a photomicrograph of that surface.

MR. DARBY: I offer that photograph in evidence and ask that it be marked Defendants' Exhibit 13.

THE CLERK: D-13 in evidence.

Q. 23. And the next one, which I think is the last? No, there are two more. All right, the next one.

A. At my request Mr. Ambrunn also ran a series of experimental etches, one of which was etched in the identical manner as their standard process, but washed in cold water. I have a photomicrograph of that.

THE COURT: In other words, they followed the first and third step in the process but eliminated the second.

THE WITNESS: Yes, sir. It corresponds to the one, I believe, which Mr. Ambrunn demonstrated here this morning, that was washed in cold water and which broke——

Q. 24. At the point of 5.

A. At the point of 5.

Q. 24. On the bump tester.

MR. DARBY: I offer this photograph in evidence [230] as Defendants' Exhibit 14.

THE CLERK: D-14.

Q. 25. The next one.

A. In order to demonstrate the effect of a reduced strength or a modified strength of solution——

Q. 26. Etching solution, you mean?

A. Of etching solution. I asked Mr. Ambrunn to make up for me a series of graded strengths, and there were provided me for this purpose four experimental bulbs in addition. The first one had water added to it. It was etched in the regular manner, but the strength of the solution was 83⅓ per cent., approximately, of that of the regular etch; but it was also washed in cold water. Then one which was 71⅞ per cent., washed in cold water. Then a third one which was 62½ per cent., and then a fourth one which was 55½ per cent. of the normal strength. I have a photomicrograph here also at 1,000 diameters of the appearance of the etch of the one which was etched in the 55½ per cent. solution to show the variation in the nature of the etch as the strength of the acid is reduced.

MR. NEAVE: Mr. Darby, excuse me a minute; I didn't hear the second percentage.

THE WITNESS: I might explain that I computed these on the basis of the percentage of water that was added, the number of cc's which were added at [231] each step, to an ounce of the solution, and it figures out, the first one 83⅓, the second 71¾,——

MR. NEAVE: That's all I wanted. Thank you.

Q. 27. Now, if I understand you correctly, this photomicrograph that you are producing illustrates the type of an etch that would be effected by an etching solution which had been diluted to approximately 50 per cent. of the normal concentration that is used in the commercial operations of Jewel.

A. Yes, sir, and then washed with cold water.

MR. DARBY: I offer this in evidence and ask that it be marked Defendants' Exhibit 15.

THE CLERK: D-15 in evidence.

[232] Q. 28. I think I can cover this by a general question, Mr. Allen. Compare, for example, D-12, which I understand is one photomicrograph of the defendant's bulb with Exhibit D-15, which is the photomicrograph of the etched surface when the etching solution employed in producing D-12 has been reduced by approximately 50 per cent., will you state what is the effect generally of reducing the concentration of the etching solution insofar as the etched surface is concerned?

A. The concentrated acid produces a very evident frosting, as has been explained by the plaintiff's witnesses, due to the throwing out of a saturated solution of the chemical which is produced by the action of the ammonium bifluoride and the hydrofluoric acid on the glass, the silica, some of it goes into direct action with the fluorin and forms a silica fluoric, which is a gas, and others come in to form a

silica fluoride, and the sodium in the glass probably unites to them and sodium fluoride or sodium ammonium, silica fluoride, probably, a complex-compound substance, and they being insoluble or less soluble in the solution become precipitated out as what we call hopper crystals; that is they produce a hollow shape, a negative crystal.

Q. 29. I didn't want to go into the chemistry quite so much, Mr. Allen. What I am trying to get at is this: I notice in D-12 there is practically a rough surface [233] throughout whereas in D-15 there are wide areas where there are no rough surfaces. Now, is that due to the decrease in the concentration of the etching solution?

A. Yes, it is, but the reason I was explaining the chemistry of the thing was to point out that as the solution becomes attenuated, there is more water there and there is less precipitation of the crystals which form the etching, although the glass itself is etched; that is all of the clear areas which are seen in D-15 have been etched but they are etched as merely flat surfaces and only an occasional crystal shows up.

Q. 30. And if the concentration is reduced substantially below 50 per cent., would the resulting photomicrographs show more and more of the flat etched surface and less of the rough surface?

A. Yes, sir.

Q. 31. That is what I wanted. Were you in the court room during the testimony of Mr. Spencer and Mr. Kurtz?

A. Yes, sir.

Q. 32. You heard their testimony that the inside surface of the Jewel lamps, in their opinion, had rounded, as distinguished from sharp angular crevices?

A. Yes, sir.

Q. 33. Construing the term "rounded" as distinguished from "sharp angular crevices", in the sense that they [234] are used in the Pipkin patent, do you agree or disagree with their testimony that the Jewel lamp has rounded, as distinguished from sharp angular crevices?

A. I do.

Q. 34. You do what?

A. I do disagree.

Q. 35. Will you please explain in detail why, using the microphotographs and such other material as you may have for that purpose to illustrate the basis for your opinion?

A. In order to state my position, I think that I should describe or define what I interpret the word "crevice" to mean, and I took the trouble to look it up in the dictionary, the Standard Dictionary, to verify my position, and I think that I am correct, that is that a crevice is a fissure or a crack or a very narrow separation, that is, a separation, I should say, between two surfaces which must be relatively deep as compared to its width. I would say that if you took a marble and pressed it into a plastic material such as putty until it made a mould of itself which was equal to its own diameter, that would not logically be called a crevice. Neither if you took a straight cylindrical rod and pressed it in would that be called a crevice. Now, if you pressed it in until the depth was considerably more than the width between the sides, then you would have what I interpret as a crevice. [235] Now, in examining Mr. Spencer's plaster casts, I think that they give a false impression from the orthostereoscopic standpoint as to the nature of the crevices, that is that the third dimension is entirely out of proportion to the depth.

Q. 36. You are referring to the plaster casts, Plaintiff's Exhibits 14 and 15?

A. Yes, sir. Now my reason for that is this, and incidentally this is supported, I believe, by Mr. Kurtz's stereophotomicrographs which show a different condition than is shown by the plaster cast. The crystallographic system in which the precipitated crystals come out, are the hexagonal or rhombohedral system. Now, depending upon the nature of the chemical itself, it has a definite relation of the horizontal or hexagonal axis to the vertical or C axis. Now, I have here, for instance, some objects which will verify that.

These are crystal models, this one being a crystal model of quartz in which the optic axis, the vertical axis, that is, bears a definite relation to the horizontal axis. Now that is different in every mineral and every chemical, but substantially the angles which should be shown in a plaster cast should be of the order of those shown by these models, that is relatively deep. Now they will, therefore, that is if you can conceive in this instance of the crystal model of quartz, if you can conceive [236] of a large number of those placed close together, the space between the crystal faces could largely be called crevice; and if they are close together they will have a sharp angular bottom to them.

THE COURT: That is true of any crystal, isn't it?

THE WITNESS: Yes, that is true of any crystal.

THE COURT: There is no such thing as a round crystal.

THE WITNESS: There is no such thing as a round crystal, but there can be a cubic crystal in which if you place them together the crevice would be infinitely narrow as compared to its depth. [237] The plaster cast should show much steeper angulation between the sides in order to properly evaluate them as crevices. Then when you come to round out the bottoms, in my estimation, his second cast, which shows the rounded bottoms, is not an interpretation of the language of the Pipkin patent, in that he has practically produced merely rounded depressions which have ceased to be entitled to be called crevices at all; and therefore it is not illustrative of a crevice with a rounded bottom. Now, the photomicrograph which I have taken of the General Electric by the reflected light, and which has been placed in evidence, I believe properly interprets that condition in that you will notice that the entire surface is composed of these crystalloid shapes between which there has been a decided rounding out. The rounding out, however, has not destroyed the crystals. When

you come to the Jewel lamp, and to a certain extent this is also true of the lamps illustrated by Mr. Spencer's photomicrographs, manufactured by the General Electric, and which I examined recently, the etch has more or less destroyed that condition. It is no longer true. Especially I would point out that the etch used by the Jewel Lamp Company in which the hot water is used directly to wash them out after the etch—that the bottoms of such cavities as are there, or crevices, are not rounded as they are in the [238] photomicrograph of the General Electric, but are more or less flat on the base with merely a radius of curvature where they join the sides of the crystals. Now, that is very well brought out, I believe, in the two views which Mr. Kurtz shows of the Jewel lamp. If you examine them you will notice that they are decidedly not round in the sense of being spherical but are flattened and merely have a radius.

By Mr. Darby:

Q. 37. Will you explain that to the Court with the stereoscope that Mr. Kurtz so kindly provided? I don't know whether that is the correct set of photographs. You had better see.

A. They are in reverse.

The Court: Well, your distinction is analogous to the distinction we might find if we were to look into the half of a rubber ball, we will say, and an opened square box, the bottom ridges of which were curved; isn't that all there is to it?

The Witness: Substantially, yes. That is, that the box, however, would have a curved radius.

The Court: Yes, it would have a flat surface for an area, and then as it reached the edges, it would curve upward.

The Witness: Yes, sir. Now,——

THE COURT: As distinguished from the same or [239] the equivalent surface in a ball.

THE WITNESS: Yes.

THE COURT: Where you have it rounded throughout to reach all sides.

MR. DARBY: I think your Honor has stated squarely what the witness means and what I have been trying to bring out.

THE COURT: Apparently you patent attorneys have been trying to confuse me for two days, trying to make these things difficult.

MR. DARBY: No, sir, I don't think we have been trying to make it difficult. We have been trying to make it easy, and have perhaps been making it a botchy job.

THE COURT: No, I was just being facetious.

MR. DARBY: No, because I know that's one of our failings.

THE COURT: I mean it seems to be a simple explanation of his distinction.

Q. 38. Now, without the use of the stereoscope do you agree with Mr. Spencer that in these pictures taken by reflected light, a spherical surface is indicated by a point, a white point, in the photomicrographs, whereas a flat surface is indicated by a wide area, almost rectangular area?

A. That is correct.

[240] Q. 39. And is that difference between the General Electric bulb and the Jewel bulb illustrated by a comparison of the photographs that you have offered in evidence as defendants' Exhibit 11 and defendants' Exhibit 12?

A. It is. I believe that the picture of the General Electric, however, is a literal interpretation of the language of the Pipkin patent. Now, I do not admit that the present General Electric pictures, or etch as illustrated by Mr.

Spencer's pictures, or Mr. Kurtz' stereo pictures, are as literal an interpretation. It is more nearly the etch; that is, it is getting away from that and toward that illustrated by the Jewel.

Q. 40. Then do I understand from that that it is your opinion that the current production of the General Electric Company is closer to the Jewel bulb, frosted bulb, on its inside than was the current production of inside frosted lamps of the General Electric Company at the time of the Wabash trial? Is that what you mean?

A. I interpret that there has been some difference in their method of etching; as Mr. Spencer testified, it may be a slight variation in the chemical formula, or it may be the use of hot water instead of cold; I don't know.

Q. 41. Well, my difficulty with scientists is getting them to answer my questions; they go ahead of me so fast. Am I correct in understanding from your testimony that [241] the current General Electric bulbs as represented by the photomicrographs that Mr. Kurtz and Mr. Spencer have put in evidence here are closer to the Jewel bulbs than the General Electric bulbs that were currently made at the time of the Wabash trial?

A. Yes, sir.

Q. 42. Is that what you mean?

A. Yes, sir.

Q. 43. And will you state whether or not it is the fact, in your opinion, that the inside frosted bulbs of the General Electric Company, of which you made photomicrographs at the time of the Wabash trial are nearer to what you interpret the Pipkin patent to be?

A. Yes, sir.

MR. NEAVE: Are you referring to Exhibit D-11?

MR. DARBY: Exhibit D-11, yes.

Q. 44. You say "Yes, sir, it is," or it is not nearer?

A. It is nearer.

Q. 45. Now, will you very briefly refer to the photomicrographs, defendants' Exhibits 13, 14 and 15, and briefly explain to the Court what they represent, and the conclusions you draw from them?

A. D-13 is the photomicrograph which I made of the bulb etched in the standard manner but washed in pure hot water, instead of in the contaminated hot water which would [242] naturally be present in the regular process. I see evidences in it of the psuedo crystals, crystal casts of the sodium, ammonium bifluorides, and I see between them what have been called crevices, and I see at the bottom of these crevices evidence of the removal of the sharp angle between them. I interpret that that the weak acid which has been present from the etch which remained in the bulb when the hot water was applied to it—that it acted in the same way that the weaker acid acted in etching the experimental bulb which was only etched with a 50 per cent. acid. In other words, it tends to eat out a flattened area between these crystals. If allowed to act long enough and the concentration of the acid were such as to do it within a reasonable length of time, it would, I believe, have completely destroyed the frost or etch and produced a substantially clear bulb again. Now, when you take the experimental bulb which was etched in the same way, but rinsed in cold water, which is illustrated by photomicrograph, defendants' Exhibit D-14, we see that the sharp angular crevices at the bottom do persist, and I think that the technical, scientific reason for that is this: that there is a reciprocity law, well known in chemistry, that concentration of a reagent and temperature are interrelated. That is, that you can get the same effect with a dilute acid at a higher temperature than you get with a more concentrated acid as the temperature is lowered.

[243] When this etched bulb therefore was washed in cold water, the cold water washed out the acid at a temperature which did not allow the concentration of the acid to operate to do further etching, and therefore there is naturally a

weakened bulb; whereas in the case of the warm water etch, the acid has tended to flatten out the space between. The action takes place more rapidly at the bottom of the crevice because of capillary attraction and also because I believe that it is chemically weaker there at a line of perhaps only one or two molecules in width. I think it should be pointed out in interpreting not only my photomicrograph but also those of Mr. Spencer and Mr. Kurtz, that the area shown here is extremely small. We have got to remember that when you are dealing with a magnification of 1000 diameters that one-thousandth of an inch becomes one inch, and therefore the width of the pictures shown—and this is true of Mr. Spencer's as well as my own—is about five inches, roughly. Therefore the entire area embraced in the width of the photomicrograph is five one-thousandth of an inch or half a hundredth of an inch, which is practically the limit of visibility of the average human eye.

Q. 46. Would you say that is about the equivalent of the size of the smallest visible spot you could make with the sharp point of a hard lead pencil and be visible [244] to the eye?

A. Yes. I think the pencil would be more apt to make it larger than is actually shown here. That means that we are talking, when we begin to talk about the diameters of the rounding of the bottom of the crevices, we are beginning to talk in terms of microns or fractions of microns. That is, a micron is one twenty-five thousandth of an inch, and we really must use that scale rather than inches in order to mean anything. And these roundings in the General Electric, as shown by the photomicrograph, exhibit D-11, these roundings which incidentally are substantially perfect spheres, and the continuation of spheres run into each other, they run from say three to seven or eight microns in diameter. I notice—well, I believe I didn't answer your question as to defendants' exhibit D-15.

Q. 47. I think you have already covered that, Mr. Allen.

A. I might add one or two other things in regard to the differences between the General Electric etch as now produced and the Jewel etch. I do not think that the areas illustrated by Mr. Spencer are really typical of the entire surface. Due to the extremely small areas which are involved, they can be made to show any extreme of variation which might be present. If you examine [245] both Mr. Kurtz's and Mr. Spencer's photomicrographs, you will discover that there is a gradual breaking up and elimination of the crevices in many parts of the Jewel area. My photomicrograph, Exhibit D-12, shows that, I think perhaps more plainly than theirs do, except in certain areas; and I think that mine is more typical of the average interior surface. There are areas in which, interpreting the term "crevice" as I do, they contain no crevices whatever. There are crevices present, and there are rounded crevices present, but they are not substantially that characteristic which should be used to describe the etch as a whole.

MR. DARBY: You may cross-examine.

THE COURT: Suppose we take our recess now.

(Recess.)

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[246] AFTERNOON SESSION.

MR. NEAVE: No cross-examination, Mr. Allen.

MR. DARBY: Defendant rests.

MR. NEAVE: Your Honor, in rebuttal the plaintiff merely wishes to offer in evidence one of the patents that was cited in the answer in this case, but which was not offered by Mr. Darby. It is the Hermann British patent No. 8198 of 1913.

MR. DARBY: I object to it as irrelevant and immaterial. I would like to know in what respect it is immaterial.

MR. NEAVE: The purpose of the offer is to show that the problem of glare was recognized in the art.

MR. DARBY: I don't think that serves any such purpose. A British patent of 1913 that was cited in the answer certainly can't serve any such purpose.

MR. NEAVE: Mr. Darby made the same objection at the last trial and I made the same answer.

THE COURT: Well, of course, I will tell you this about it, from my own personal observation: that anyone who can say the exposed filament didn't present a problem of glare may have been slightly mistaken, because it seems to me to be obvious. It is like the open flame in front of your eyes. An open filament is equivalent to the same thing. [247] If it wasn't a problem we wouldn't have all these fancy fixtures and different things, shades and the like. Direct light has always been a problem, even when it came to the windows; it hit you right in the face.

MR. NEAVE: I will withdraw the offer of the exhibit then, your Honor. That closes our case.

THE COURT: I don't think it can be seriously argued that the effect of direct light hasn't presented some problem. I think the Court can take judicial notice of it, based on the sun.

MR. DARBY: It is a matter of degree.

THE COURT: Well, I know; that's what directs us, I suppose, in the arts and sciences to improvements.

MR. DARBY: I think it is a matter of degree and I think it is also a matter of individual reaction.

THE COURT: You know, there were days when probably your father and my grandfather thought nothing of walking a hundred yards to the back yard, you know. Now they walk upstairs.

MR. DARBY: I can also recall that in our fathers' or grandfathers' day they spent the whole night reading by candlelight, gas light, and what not; and if we catch any of

our youngsters today reading with but a single bulb, we scold them terribly.

[248] THE COURT: Yes, that's right.

MR. NEAVE: What is your Honor's desire about briefs, sir?

MR. DARBY: You rest your case?

MR. NEAVE: Yes.

MR. DARBY: We rest too.

PLAINTIFF'S EXHIBITS

PLAINTIFF'S EXHIBIT P-1.

Photostat of Labels on Jewel Carton.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-2.

Bill of Ellis G. Davidson Co., Inc., Dated February 28, 1936.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-3.

Letter from E. Brodbeck & Sons to Jewel Incandescent Lamp Co., Dated March 20, 1936.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-4.

Letter from Jewel Incandescent Lamp Co. to E. Brodbeck & Sons, Dated March 28, 1936.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-5.

Receipt of Ellis G. Davidson Co., Inc., to E. Brodbeck & Sons, Dated February 28, 1936.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-6.

Photostat of Labels on Cartons of Incandescent Lamp Company, Containing Lamp.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-7.

Invoice of Ellis G. Davidson Co., Inc., to E. Brodbeck & Sons, Dated March 28, 1936.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-8.

Sleeve of General Electric Lamp, in Connection with a Stipulation With Regard to Marking.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-9.

Oct. 16, 1928. **1,687,510**

M. PIPKIN

ELECTRIC LAMP BULB

Filed June 29, 1925 2 Sheets-Sheet 1

Fig. 1

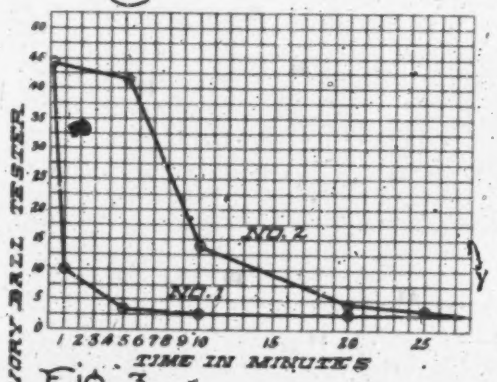


Fig. 2

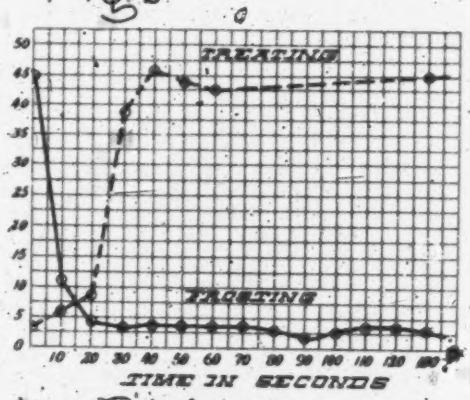


Fig. 3

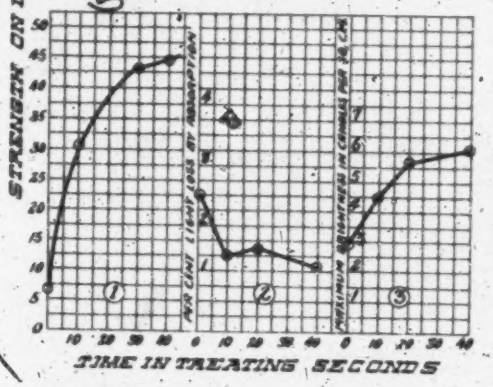


Fig. 4

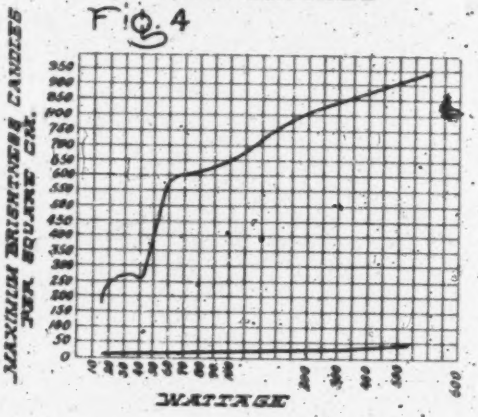


Fig. 6

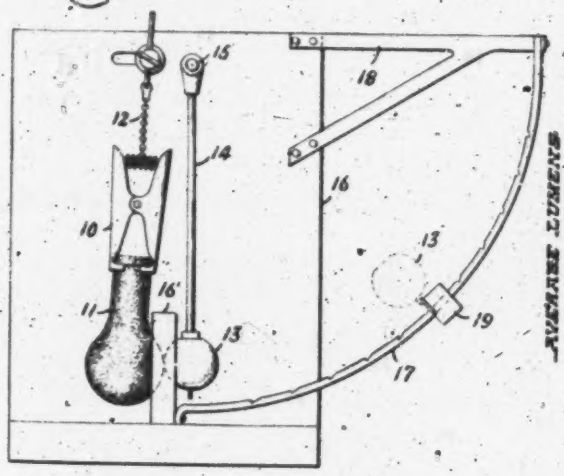
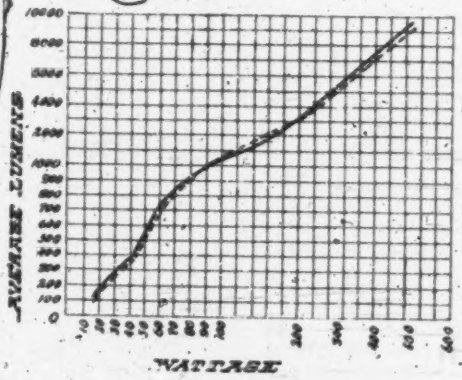


Fig. 5



INVENTOR:
MARVIN PIPKIN,
BY Alexander S. Lunt
HIS ATTORNEY.

Oct. 16, 1928. **1,687,510**

M. PIPKIN

ELECTRIC LAMP BULB

Filed June 29, 1925 2 Sheets-Sheet 2

Fig. 7

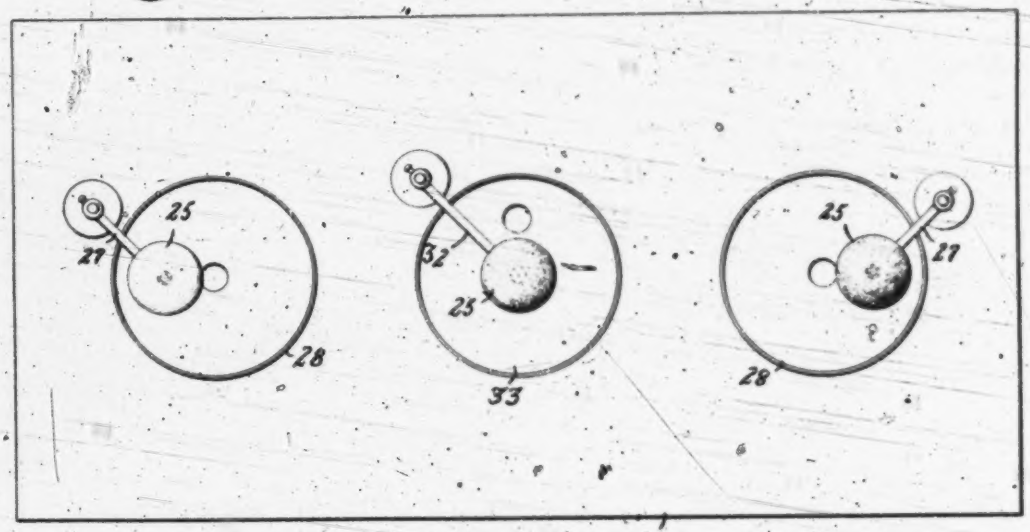
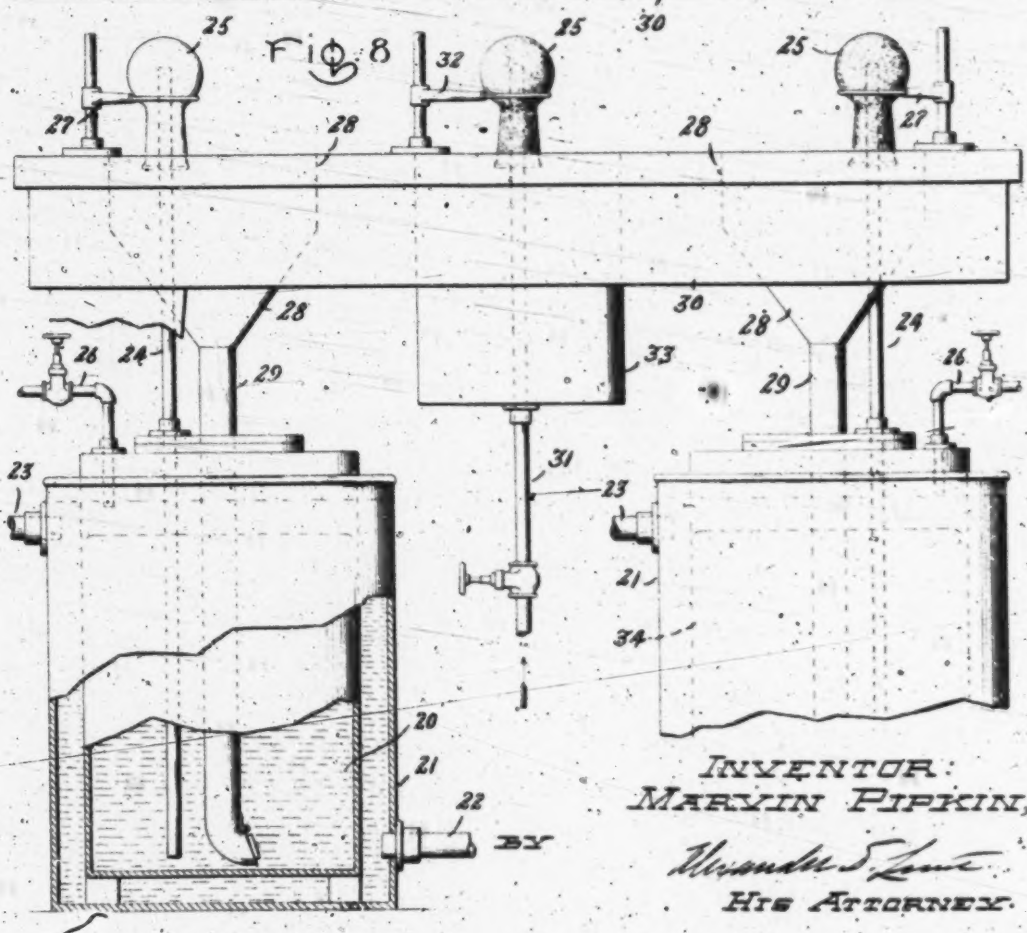


Fig. 8



INVENTOR:
MARVIN PIPKIN,

BY

Alexander S. Lent

HIS ATTORNEY.

Patented Oct. 16, 1928. **1,687,510**

UNITED STATES PATENT OFFICE.

MARVIN PIPKIN, OF CLEVELAND HEIGHTS, OHIO, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC-LAMP BULB.

Application filed June 29, 1925. Serial No. 40,152

My invention relates to bulbs for electric lamps and more particularly to frosted bulbs for such lamps. This application is a continuation in part of my application Serial No. 690,672, filed February 4, 1924.

An important feature of my invention is an improved method of frosting bulbs and other thin glassware on the inside. Inside frosting has advantages over outside frosting. This is particularly true in the case of illuminating glassware since better diffusion with lower absorption of light is obtained. Another advantage of the inside frosting, which applies generally, is that the outer surface of the article is left smooth and, therefore, does not collect dirt easily and may be easily cleaned. There are other instances where inside frosting is desirable to improve the appearance or to perform other functions in the operation of the device. The preferred method of frosting is by removal of material, that is, by etching, rather than by application of coatings. However, as heretofore produced, bulbs and similarly thin articles thus frosted on the inside have been fragile to such a degree as to occasion prohibitive breakage. Bulbs ordinarily used for incandescent lamps are between 10 and 90 mils in thickness, averaging between 15 and 70 mils, and apparently, the application of the inside frost by etching has weakened them so that they have been very easily broken. The object of my invention is to produce an inside frosted glass bulb which will be much stronger than those heretofore produced.

The prior art makes no distinction between the methods of inside and outside frosting. The frosting on the outside has been accomplished by sand blasting or by the use of a chemical frosting medium. Frosting by etching is to be distinguished from the etching without frosting as the former produces a fine grained rough surface which appears more or less white while such etching without frosting produces a surface which is substantially colorless. The unfrosted etched glass is not sufficiently diffusing for lamp bulbs. The preferred method of frosting is by the use of a chemical medium. For lime glasses the presence of an ammonium compound in addition to the hydrofluoric acid seems to be necessary. The effect is improved by the addition of finely divided inert materials such as barium sulphate. In some cases the presence of sodium salts such as sodium sulphate is of advantage. Dextrin or flour may also be added in order to cause better adherence of the mixture to the glass surface. The degree of frosting depends upon three factors; first, the strength of the frosting mixture as indicated by the percentage of hydrofluoric acid present; second, the temperature of the mixture; and third, the time during which the bulb is exposed to the frosting mixture. Ordinarily the stronger the mixture, the higher the temperature, and up to a certain point, the longer the time, the greater the degree of frosting. When the inside surface of a lamp bulb is subjected to these frosting mixtures to the extent necessary to produce a practical frost, that is, one which will produce the proper light diffusion, the article becomes extremely fragile. I have found, however, that if the bulb is given a further treatment, which I term a strengthening treatment, in which it is subjected to an etching or frosting treatment of lower degree than that to which it was first subjected, it becomes quite strong. Indeed, it may be made practically as strong as the original clear glass bulb. The use of a weaker etching medium for the treating step is preferable to lessening the time or temperature. An etching solution becomes weaker with use and so, good results may be sometimes secured by using, for the strengthening treatment, the used frosting solution.

In the drawing, Fig. 1 is a diagram showing the effect of inside frosting on the strength of a bulb; Fig. 2 is a diagram showing the results of the strengthening treatment comprised by my invention; Fig. 3 is a diagram showing the effect of the strengthening treatment on the strength, the light absorption and the diffusion of the bulb; Fig. 4 is a diagram showing the variation of the various sizes of lamps in maximum brightness; Fig. 5 is a diagram showing the variation in absorption; Fig. 6 is an elevation of a bulb strength tester; Fig. 7 is a plan and Fig. 8 is an elevation partly in section of an apparatus for applying the frosting and strengthening treatments.

In Fig. 1 the ordinates represent the strength of the bulb as determined by the ivory ball tester hereinafter described. The abscissas represent the time in minutes during which the inside of the bulb is subjected

to the frosting mixture. There are two curves. In obtaining curve No. 1; the following frosting mixture was used:

	Per cent.
Ammonium bifluoride	36
Dextrin (powder)	10
Barium sulphate	28
Sodium bi-sulphate	5
Water	21

This mixture contained 11.9% hydrofluoric acid. The temperature was 20° centigrade. For test No. 2 the above mixture was diluted with water and the mixture used was constituted as follows:

	Per cent.
Ammonium bi-fluoride	25
Dextrin	6.9
Barium sulphate	19.32
Sodium bi-sulphate	3.45
Water	45.33

The temperature was 20° centigrade. The frosting mixture contained 8.34% hydrofluoric acid. In test No. 1 and test No. 2 a fresh solution was used in each bulb frosted. In both cases the mixture was poured into dry bulbs and allowed to remain for the time specified. In test No. 1 five sets of bulbs were tested, each set containing five bulbs. The tests were made at zero, one minute, five minutes, ten minutes and twenty minutes. The average showed an initial strength of 44.8; 9.8 after one minute; 2.6 after five minutes; 2.2 at ten minutes and about the same at twenty minutes. The bulbs which were frosted for one minute did not have enough frosting to make them practical for use. In test No. 2 a similar number of bulbs were tested and the average was 44.8 at zero; 42.2 at five minutes; 13.8 at ten minutes; 4.2 at twenty minutes and 2.6 at twenty-five minutes. The bulbs frosted for five minutes were almost like clear bulbs. Those for ten minutes had just a slight haze but were unsuitable for use in lamps.

A bulb having a strength less than 7, which is about 16% that of the clear bulb, would be too fragile for handling commercially. In practice it is aimed to keep the strength above 20 or about 45% that of the clear bulb. It is apparent therefore from the above test results that when the frost was sufficient to produce practical diffusion, the bulb was prohibitively weak.

Fig. 2 shows the effect of the strengthening treatment comprised by my invention. The frosting mixture used had an acidity of 11.8% hydrofluoric acid and the temperature was 50° centigrade. The mixture was sprayed over the inside of the bulb for five seconds, and after five seconds it was sprayed again and this continued for the period of the test. The time is indicated in seconds and represents the time during which the frosting mixture was in contact with the bulb. The clear bulbs were washed out with water at about 45° centigrade just before being sprayed. The curve marked "Frosting" was derived from five sets of bulbs of five bulbs each. The average showed a strength of 44.8 at zero; 11 at 10 seconds; 4.2 at twenty seconds; 3 at thirty seconds, and so on as indicated in the full line curve. The bulbs frosted for ten seconds had only a slight haze and were unsuited for practical use. Those frosted for twenty seconds were not uniform. Those at thirty seconds were better, and from then on the bulbs were suitable.

In Fig. 2 the broken line curve marked "Treating" was derived from the results of tests in which five sets of bulbs of five each were used. The bulbs treated had been frosted and showed an average strength of 3.2 on the ivory ball tester. The mixture used contained 7.44% hydrofluoric acid, 40% barium sulphate and 2% dextrin. The procedure followed was the same as followed in the case of the frosting, i. e. the mixture was sprayed over the interior surface of the bulb. The curve shows that the initial strength was 3.2; that after thirty seconds treatment the strength was 39.6; and that after this time the strength rose to substantially the same as that of the clear bulb. It has been found in practice that thirty seconds under these conditions is a desirable period and the curve shows that during this time the strength increased from 3.2 to 39.6, or 11.37%.

In order to obtain comparative information regarding the effect of exterior and interior frosting, tests were conducted in which a uniform selection of lime glass bulbs was made. These were divided into two portions. One portion was frosted inside and the other on the outside. Of the portion which was frosted on the inside some were given the strengthening treatment and some were not, and the amount of the strengthening treatment was varied. The strength tests were obtained from samples and lamps were made from the remaining bulbs. The lamps were the ordinary tungsten 115 volt, 40 watt lamps of the vacuum type and made according to standard practice. Photometric tests were then made of the lamps so as to determine the maximum brightness in candles per square centimeter which indicates the amount of diffusion. The absorption by the bulb was also determined, the loss in lumens being expressed in percentage. The results showed the average for the clear bulbs to be strength 44.8; absorption 0; and maximum brightness 201.8. Lamps frosted on the outside showed strength 44.8; absorption 5.13; and maximum brightness 5.36. Lamps frosted on the outside for a longer time showed strength 44.8; absorption 3.96; and maximum brightness 5.4. Lamps frosted on the inside but which were not given the strengthening treatment showed strength 6.8; absorption 2.25;

and maximum brightness 3.02. Lamps frosted on the inside and given the strengthening treatment comprised by my invention for ten seconds showed strength 30.4; absorption 1.22; and maximum brightness 4.5. Those treated for twenty seconds showed strength 42; absorption 1.27; and maximum brightness 5.6. Those treated for forty seconds showed strength 44.8; absorption 1.07; and maximum brightness 5.92. These results indicate that the inside frosted lamps have greater diffusion and lower absorption than the outside frosted lamps. They also indicate that by the strengthening treatment the strength is brought up so that the lamp can be practically handled, and that while the maximum brightness is increased, or in other words, the diffusion is reduced, still the absorption is lessened. Moreover, the diffusion is substantially as good as that of the outside frosted lamps.

Fig. 3 is a diagram showing the effect of treating. Curve 1 shows the strength, curve 2, the absorption and curve 3 the maximum brightness. The treating solution had an acidity of 5.2% hydrofluoric acid and the temperature was 55° centigrade. These curves indicate that treating enormously increases the strength of the bulb. It increases the maximum brightness somewhat but not to an objectionable extent and at the same time this is compensated for to a certain extent by the lowering of the absorption. The curve shows that, after a treatment of ten seconds, the strength had been increased from 6.8 to 30.4, while the brightness had been increased from 3 to 4.5, and on the other hand the absorption had been lowered from 2.25 to 1.22.

The tests upon which the curves shown in Fig. 4 are based were made to show the relation between the maximum brightness of the inside frosted bulb lamp and the corresponding clear bulb lamp for the various wattages. The curve shows the following values:

Wattage	Maximum brightness (clear)	Maximum brightness (inside frosted)	Per cent
15	176	2.33	1.3
25	261	4.1	1.6
40	250	5.2	2.0
60	596	9.2	1.55
100	632	12.3	2.0
100 (daylight)	269	6.4	2.4
200	807	19.9	2.6
500	925	39.0	4.2

These tests indicate that for ordinary incandescent lamps, the average maximum brightness for inside frosted lamps, frosted according to my invention, is below 4.5% of that of the clear bulb lamp of the same wattage. Heretofore bulbs inside frosted so that the maximum brightness of the frosted lamp was below fifty per cent of that of the clear bulb lamp had a strength below 16% of that of the clear bulb.

The full line curve in Fig. 5 shows the output in lumens of the clear bulb lamp and the dotted line shows the same for a lamp having a bulb inside frosted by my invention. The small percentage loss in lumens caused by the inside frost will be apparent.

In obtaining the curves of Figs. 1, 2 and 3, the measurement of strength of bulb was made by means of the ivory ball tester shown in Fig. 6. This device consists of a spring clamped holder 10 adapted to receive and hold securely a bulb 11. The holder and bulb are suspended as by means of a chain 12 so as to allow them to swing. The blow is applied by means of an ivory ball 13 which is mounted on a rod 14 pivotally suspended at 15 to the frame 16. The force of the blow delivered by the ivory ball depends upon the length of the arc through which it swings. It strikes the bulb through a circular passage in the block 16 into which the bulging portion of the bulb extends. A gauge is provided consisting of an arcuate scale 17 suitably graded and supported from the frame 16 by a suitable bracket 18. A slidable marker 19 provides a guide for the starting of the pendulum swing of the ivory ball in each case.

In Figs. 7 and 8 are shown an apparatus which I have devised for the application of the inside frosting and treating. This apparatus comprises a suitable reservoir 20 surrounded by a water jacket 21 having inlet and outlet pipes 22—23. Water may be circulated through the water jacket at a suitable temperature to maintain the frost mixture contained in the reservoir 20 at the desired temperature. The frosting mixture is forced up through the pipe 24 to the bulb 25 by air pressure applied through the pipe 26. A suitable holder 27 is provided which serves to support the bulb. The surplus frosting mixture returns to the reservoir through the funnel 28 and pipe 29. Fresh solution may also be added through the same means. Conveniently mounted on the same frame 30 as the frosting apparatus is the washing means consisting of the water pipe 31 which projects up above the frame so that the bulb 25 may be placed thereover, said bulb being supported in the holder 32. After the bulb has been frosted it is washed by this means and the overflow goes into a reservoir 33. On the same frame is also mounted the apparatus for giving the bulbs the strengthening treatment hereinbefore referred to. This apparatus, as shown, is a duplicate of the apparatus used for the first frosting. As hereinbefore stated, it is preferred to use a weaker solution in the strengthening mixture reservoir 34 from that used in the frosting mixture reservoir 20.

As set forth in my application Serial No. 690,672, filed February 4, 1924, and hereinbefore referred to, the probable explanation of the fact that the bulbs made according to my

invention have a higher strength than those inside frosted by simple application of the frosting treatment which has heretofore been applied to the outside, is that in the latter case the surface of the glass is covered by a multitude of depressions or pits having sharply defined angles while the depressions or pits where my invention is employed are more or less rounded.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than twenty per cent of that of the clear bulb.

2. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than forty-five per cent of that of the clear bulb.

In witness whereof, I have hereunto set my hand this 28th day of June, 1925.

MARVIN PIPKIN.

CERTIFICATE OF CORRECTION.

Patent No. 1,687,510. **Granted October 16, 1928, to**

MARVIN PIPKIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 98, for "11.37 percent" read "1137 percent"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of November, A. D. 1928.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

PLAINTIFF'S EXHIBIT P-10.

Transcript of Record in General Electric Company v. Sales Save Co., Volume 1.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-10A.

Transcript of Record in General Electric Company v. Save Sales Co., Volume 2.

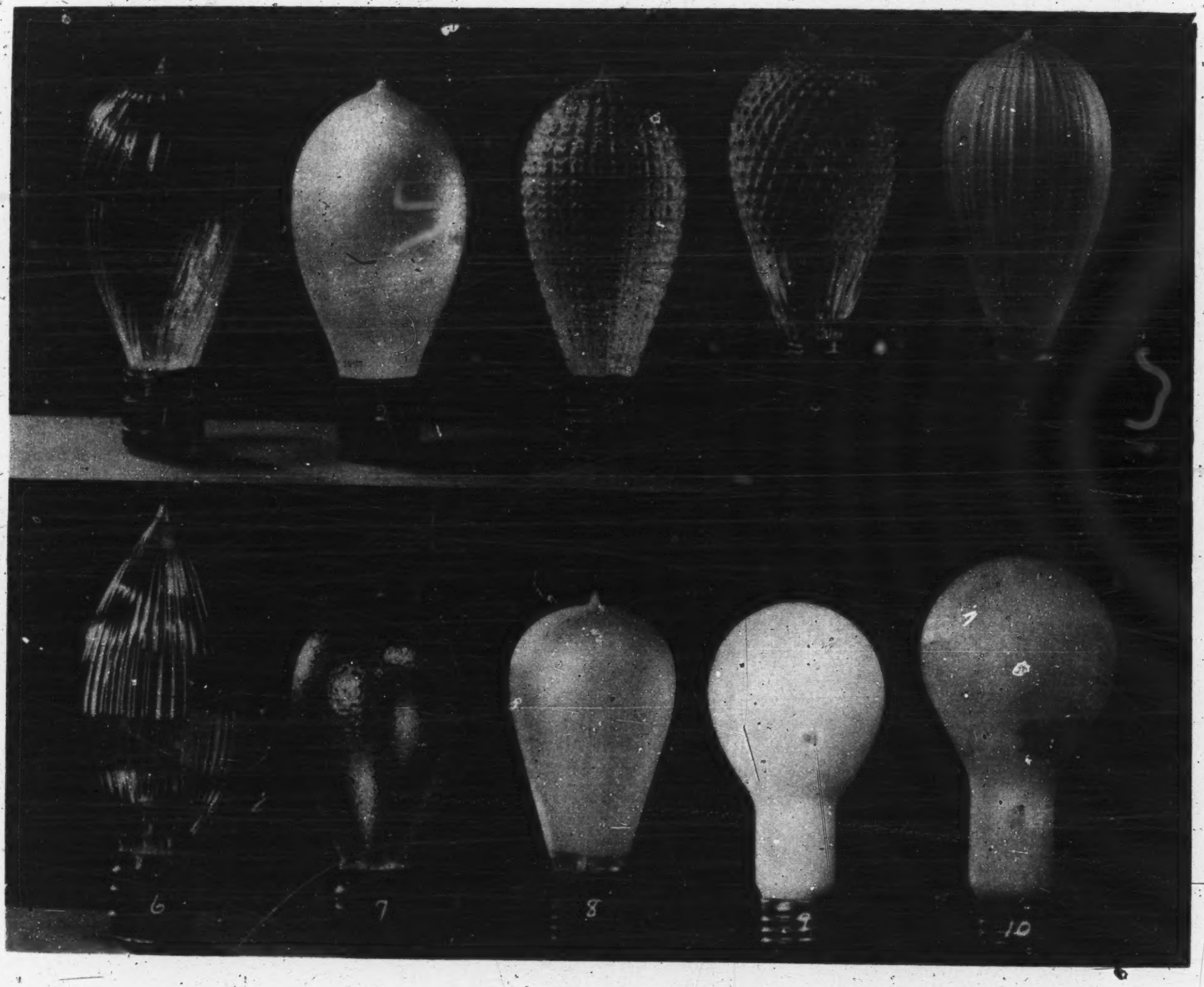
(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-11.

Transcript of Record in General Electric Company v. Wabash Appliances Corporation, et al.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-12.



PLAINTIFF'S EXHIBIT P-13.

Photostats of Five Advertisements in the "Electrical World" and "Saturday Evening Post", Showing White Mazda Lamps.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-14.

Mold.

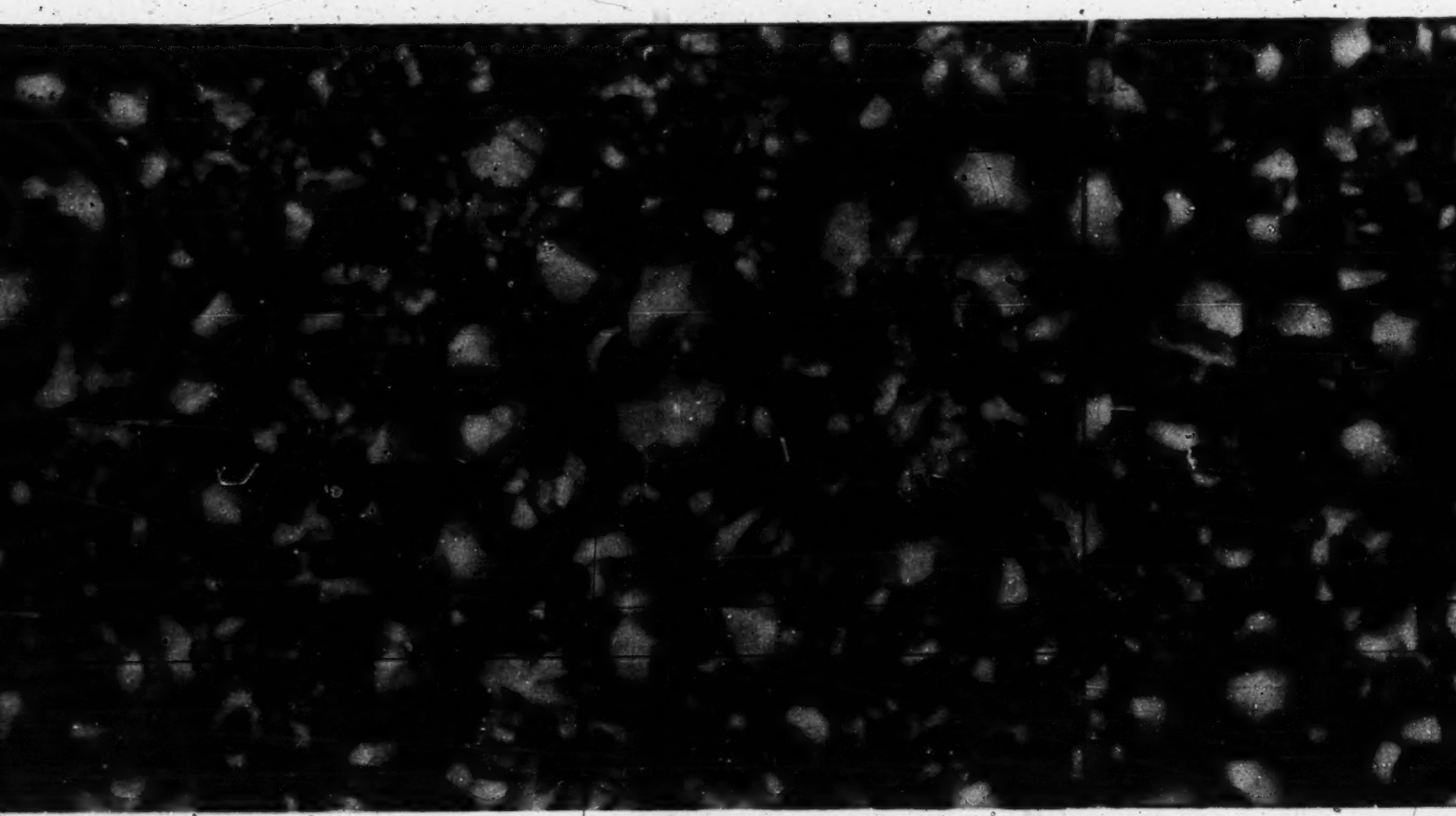
(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-15.

Mold.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-16.



G. E. INSIDE FROSTED BULB SURFACE
ZONE A
Illumination—TRANSMITTED.

PLAINTIFF'S EXHIBIT P-17

Lamp in Sleeve "Jewel", Base Marked 82.

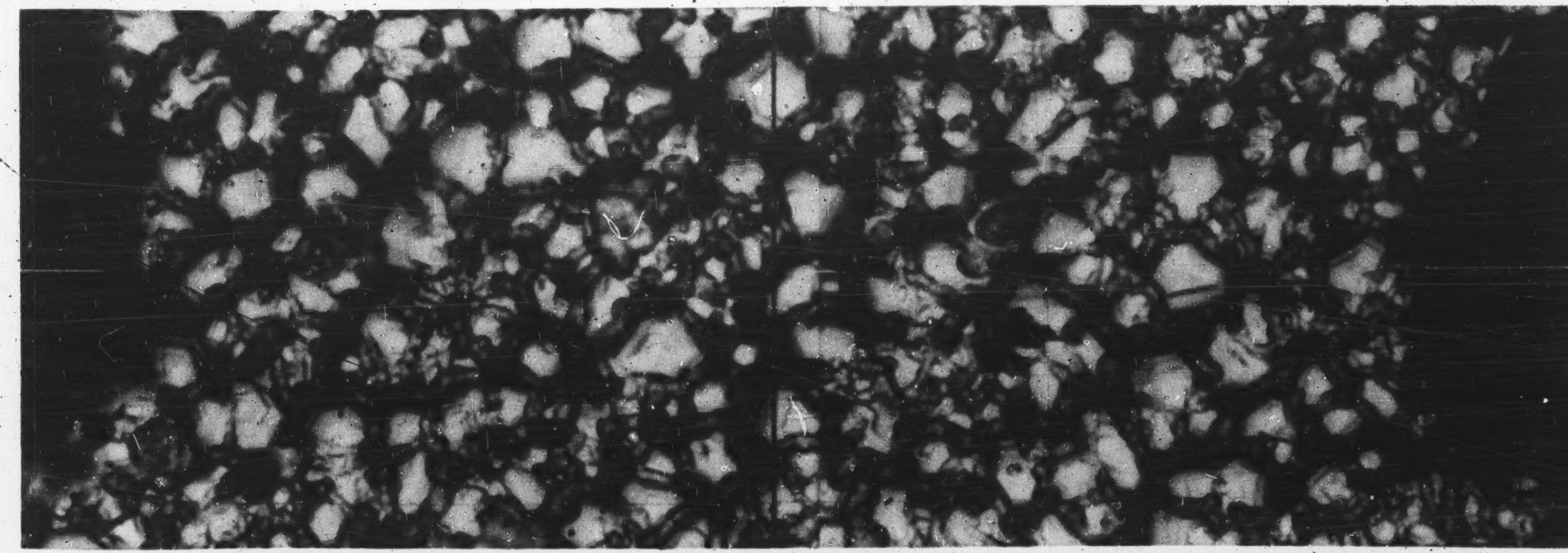
(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-18.

Lamp in Sleeve "Jewel", Base Marked 82-A.

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-19.



JEWEL INSIDE FROSTED BULB SURFACE
25-WATT LAMP
BASE MARK 82, LAMP NO. 2
ZONE A

Illumination—TRANSMITTED.

PLAINTIFF'S EXHIBIT P-20.

Photomicrograph of General Electric Lamp Fragment, "Top-left, XXI".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-20A.

Photomicrograph of General Electric Lamp Fragment, "Top-right, XXI".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-21.

Photomicrograph of Jewel Lamp Fragment, "Top-left, CII".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-21A.

Photomicrograph of Jewel Lamp Fragment, "Top-right, CII".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-22.

Photomicrograph of Jewel Lamp Fragment, "Top-left, CVIII".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-22A.

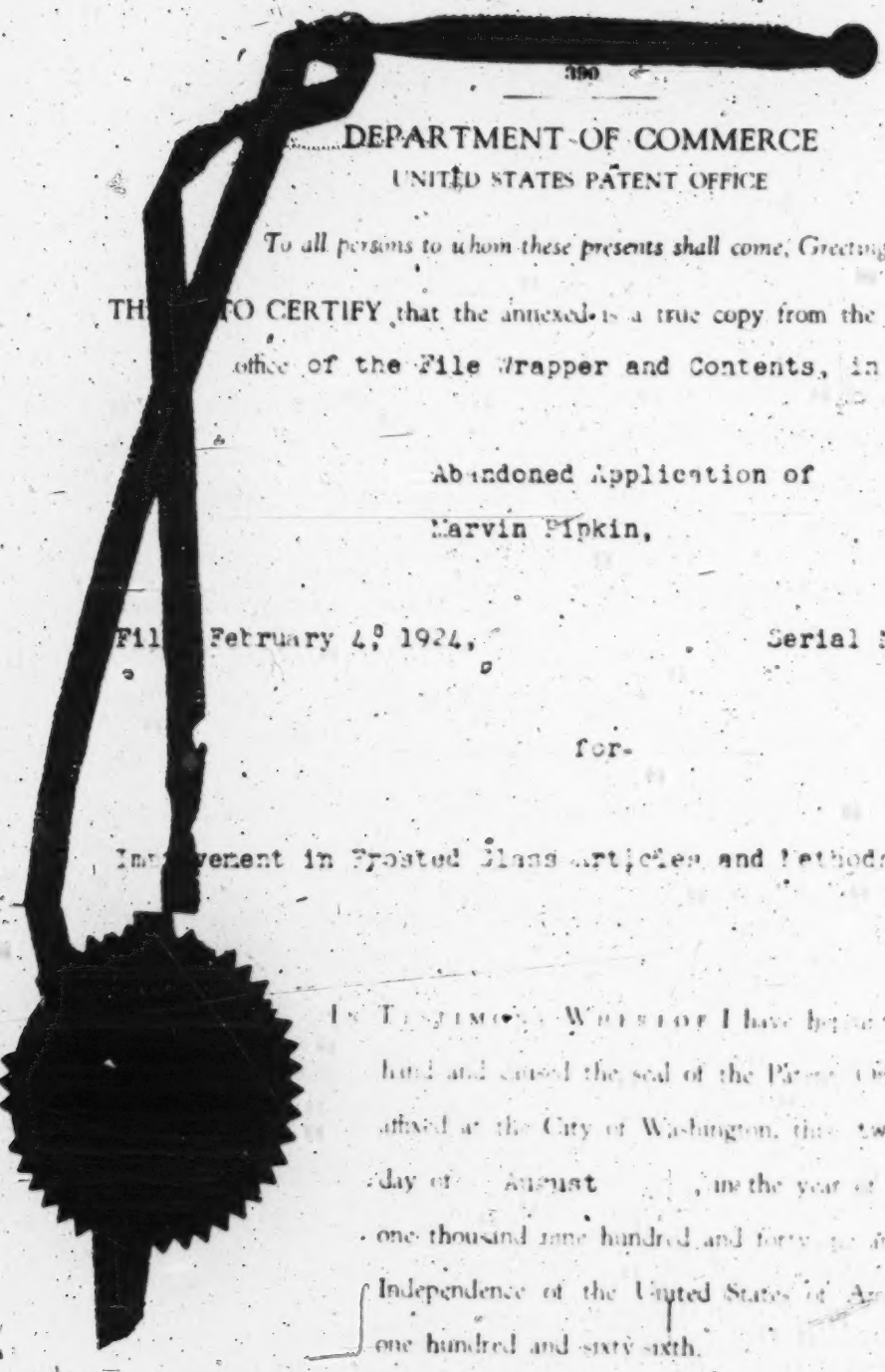
Photomicrograph of Jewel Lamp Fragment, "Top-right, CVIII".

(Physical Exhibit.)

PLAINTIFF'S EXHIBIT P-23.

Stereoscopic Viewing Machine, Introduced by Witness Kurz.

(Physical Exhibit.)



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DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the File Wrapper and Contents, in the matter of the

Abandoned Application of

Marvin Pipkin,

Filed February 4, 1924, Serial Number 690,672,

for

Improvement in Frosted Glass Articles and Methods of Making Same.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this twentieth day of August, in the year of Our Lord one thousand nine hundred and forty-six and of the Independence of the United States of America the one hundred and sixty-sixth.

ATTEST

Chief Division

Commissioner of Patents

NUMBER (Series of 1915)

1924

DIV.

PATENT No.

Name

Date of

Invention

ORIGIN

RENEWED

APPLICATION FILED COMPLETE

PARTS OF APPLICATION FILED

Petition

Oath, Filing Fee

Sheets Drawing

This application referred to in Patent No.

Do not destroy. (See order No. 3166, 400 O.G. 1)

Examined and passed for

Notice of Allowance

Final Fee

Issue

Attorney

Division of Appl. No.

Print Claim

Class (Cl.)

JUN 2 8 1926

1925

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Commonwealth	7		30. Notice of Suit April 24-1933
	73 APR 1 8 1928		31. Notice of Suit Sept. 26-1933
	Apr. 27/1928		32. Notice of Suit Sept. 26-1933
	6 MAY 26 1928		33. Notice of Suit Oct. 5-1933
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Notice of Suit	Dec. 20-1932		45.
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Notice of Suit	Dec. 20-1932		47.
Notice of Suit	Dec. 27-1932		48.
Notice of Suit	Dec. 27 1932		49.
Notice of Suit	Jan. 4-1933		50.

Plaintiff's Exhibit P-24

PETITION

To THE HONORABLE COMMISSIONER OF PATENTS:

Your petitioner, Marvin Pipkin

a citizen of the United States, residing at Cleveland Heights,

in the County of Cuyahoga, State of Ohio

whose Post Office address is 3815 Parkdale Ave., Cleveland Heights, Ohio

prays that Letters Patent may be granted him for the improvement in

Frosted Glass Articles and Methods of Making Same

D- 32,781

set forth in the accompanying specification.

And he further prays that you will recognize Mr. Alexander D. Lunt, of Schenectady, New York, as his attorney, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Marvin Pipkin

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN, that I, MARVIN PIPKIN, a citizen of the United States, residing at Cleveland Heights, in the County of Cuyahoga, State of Ohio, have invented certain new and useful improvements in FROSTED GLASS ARTICLES AND METHODS OF MAKING SAME, of which the following is a specification:

My invention relates to frosted glass bulbs such as are utilized in electric incandescent lamps and similar electrical devices, and to other frosted glass envelopes ~~articles~~ in which the glass is thin and subject to breakage. My invention also relates to methods of preparing the frosted surface on such articles. It finds particular application to articles which are frosted on the inside. In the case of electric incandescent lamp bulbs, it has been recognized that an inside frosting is highly desirable since the advantage of light diffusion is secured thereby without the disadvantage of increased susceptibility to collection of dirt which exists when the bulb is frosted on the outside. In order to avoid the introduction of detrimental foreign materials into the lamp as much as possible, such frosting must be done by etching the glass either mechanically as by sand blasting, or chemically by reagents which have a solvent action on the glass. It has been found, however, that such bulbs are weak and break easily in response to shock. This has been shown by subjecting such lamps to the so-called "bump" test which has demonstrated that they are much weaker than the unetched bulbs and also bulbs which have been etched on the outside. The object of my invention is to overcome this defect.

According to my invention, after the thin glass article has been etched on the inside, preferably by chemical

means, it is treated with a chemical which has a solvent action on the material of the etched surface. The glassware is found thereafter to have much higher resistance to shock, as shown by the "bump" test. The probable explanation is that the first etching produces pits in the glass having comparatively sharp angles and that these are rounded out by the treatment comprised by my invention which may be called a strengthening treatment. The sharp angled pits or depressions caused by the first etching are starting places for cracks when the bulb is subjected to shock and the rounding of such pits or depressions apparently effectually prevents such formation of cracks.

Although the scope of my invention includes other reagents having the solvent action on the etched surface, I prefer to use for this purpose a solution of alkalin fluoride combined with hydrofluoric acid. Ammonium bi-fluoride NH_4HF_2 and other combinations of the ammonium fluoride NH_4F with hydrofluoric acid HF, are especially efficient. Potassium bi-fluoride and corresponding combinations of such bi-fluoride with hydrofluoric acid, and also sodium bi-fluoride and its variations, may be used but are not as satisfactory. The same is true of other materials which are ordinarily used in etching glass, such as caustic soda, caustic potash and the acids.

I will now describe a specific application of my invention which has been used for frosting incandescent lamp bulbs on the inside.

1. The bulb is cleaned preferably by a solution of ammonium bi-fluoride NH_4HF_2 fairly dilute. I have used a five to fifteen per cent solution. Roughly one pound of ammonium bi-fluoride to a gallon of water may be used.

2. The bulb is then washed with water.

3. The next step is to apply the usual etching. This has been done with the so-called "safety frost" which is a preparation which etches the bulb and at the same time can be handled without especial care which is necessary when hydrofluoric acid is used. The preparation is made from the following:

185 pounds, 4 ounces ammonium bi-fluoride
66 pounds water
52 pounds, 12 ounces sodium bi-sulphate

These are placed in a steel ball mill and ground for one hour afterwhich 203 pounds of precipitated barium sulphate and 46 pounds, 8 ounces of so-called foundry flour is added and the grinding continued for three hours. The bulbs are filled with this liquid and allowed to stand three to seven minutes after which they are emptied and washed out with hot water.

4. The next step is to wash with water if this has not been thoroughly done.

5. The bulbs are then treated with etching solution, preferably ten to twelve per cent ammonium bi-fluoride in water. The previously etched surface is exposed to this for some time. I have found that five minutes is about right. It is best to have the solution slightly warm, about 80° Centigrade being suitable.

I have used a modification of the above described method which has proven quite effective and which is somewhat simpler and more economical. It differs from the first method in that instead of using additional material for the strengthening treatment, I utilize a portion of the original etching material. After the "safety frost"

mixture, which is introduced into the bulb to etch the same, is removed from the bulb there is sufficient of the material remaining to accomplish the strengthening treatment if the step of washing is omitted. It is necessary merely, after the removal of the frosting solution, to fill the bulb with warm water and agitate it by shaking. The solution which is formed is sufficient to accomplish strengthening of the bulb if allowed to remain a sufficient time which must be at least ten minutes. This method is applicable more especially to the smaller sized bulbs.

1 What I claim as new and desire to secure by Letters Patent of the United States, is:-

1.The method of treating etched glass lamp bulbs and similarly thin glass articles which consists in subjecting the etched surface to the action of a reagent having a solvent action on the material of said surface.

2. The method of treating glass lamp bulbs and similarly thin glass articles which consists in etching a surface thereof and afterwards subjecting the etched surface to the action of a reagent having a solvent action on the material of said surface.

3. The method of treating glass lamp bulbs and similarly thin glass articles which consists in chemically etching a surface thereof and afterwards subjecting the etched surface to the action of a reagent having a solvent action on the material of said surface.

4. The method of treating etched glass lamp bulbs and similarly thin glass articles which consists in subjecting the etched surface to the action of a fluorine containing reagent.

5. The method of treating etched glass lamp bulbs and similarly thin glass articles which consists in subjecting the etched surface to the action of an alkalin fluoride containing reagent.

6. The method of treating etched glass lamp bulbs and similarly thin glass articles which consists in subjecting the etched surface to the action of a reagent containing ammonium bi-fluoride.

7. An article of glass of a thickness similar to that of an incandescent lamp bulb and having a surface thereof covered with rounded etching pits or depressions.

8. A bulb for electric lamps and similar articles having its inner surface covered with rounded etching pits or depressions.

9. An incandescent electric lamp bulb having on its inner surface rounded etching pits or depressions.

IN WITNESS WHEREOF, I have hereunto set my hand this 31st day of January, 1924.

Marion Pipkin

JHA/KBC.

AFFIDAVIT

STATE OF Ohio }
COUNTY OF Cuyahoga } SS.:

Marvin Pipkin the above named petitioner, being duly sworn, deposes and says that he is a citizen of the United States and resident of Cleveland Heights, in the County of Cuyahoga, State of Ohio, and that he verily believes himself to be the original, first, and sole inventor of the improvements in Frosted Glass Articles and Methods of Making Same described and claimed in the annexed specification; that he does not know and does not believe that the same were ever known or used before his invention or discovery thereof; or patented or described in any printed publication in any country before his invention or discovery thereof or more than two years prior to this application; or patented in any country foreign to the United States on an application filed by himself or his legal representatives or assigns more than twelve months prior to this application; or in public use or on sale in the United States for more than two years prior to this application; and that no application for patent on said improvements has been filed by him or his representatives or assigns in any country foreign to the United States.

Marvin Pipkin

Sworn to and subscribed before me this 31st day of January, 1941

Notary Public

Plaintiff's Exhibit P-21

Paper No. 2

DEPARTMENT OF THE INTERIOR

WHH/ts **UNITED STATES PATENT OFFICE**

WASHINGTON September 10, 1924.

PATENT OFFICE
SEP 10 1924
E.D.

Alexander D. Lunt,
C/o General Electric Co.,
Schenectady, N. Y.

Please find below a communication from the EXAMINER in charge of the application of

Marvin Pipkin, Sr. No. 690,672, Filed Feb. 4, 1924
FROSTED GLASS ARTICLES AND METHODS OF MAKING SAME.

Thomas E. Robertson
Commissioner of Patents.

This application has been examined.

A drawing is required as the process and article can readily be illustrated.

Claims 1 to 6 inclusive are rejected as unpatentable over

WOOD 1,240,398 Sept. 18, 1917 41-42

In this patent, electric lamp bulbs and similar articles are subjected to a sand blast to form small depressions in them and their surfaces are then treated with an etching compound to make rounded pits or depressions.

Claim 7 is rejected on Wood.

Claims 8 and 9 are rejected on Wood. It is old to etch the inside surfaces of lamp globes as stated by the applicant in his specification, lines 15 to 20, page 1.

The following are made of record:

KENNEDY 733,972 July 21, 1903 41-42
HAGEMAN 1,471,466 Oct. 23, 1923 41-42

A S Miller
Acting Examiner, Div. 51.

WHHH

PATENT OFFICE

AMENDMENT

IN THE UNITED STATES PATENT OFFICE

In re Application of
MARVIN PIPKIN,
Serial No. 690,678,
Filed February 4, 1924,
Div. 51 - Room 240 - Annex.

FROSTED GLASS ARTICLES AND METHODS OF MAKING SAME.

PATENT OFFICE
AUG 27 1925
DIV. 51 FILED

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In response to Office Action of September 10, 1924, please amend the above-entitled case as follows:

Please cancel the claims and substitute therefor the following:

1. The method of inside frosting lamp bulbs and similarly thin glass articles which consists in etching the same to produce a white appearing surface and afterwards subjecting the same to the action of an etching reagent without destroying the white appearance thereof.

2. The method of inside frosting lamp bulbs and similarly thin glass articles which consists in etching the same to produce a white appearing surface, then washing the same and afterwards subjecting the same to the action of an etching reagent without destroying the white appearance thereof.

3. The method of inside frosting lamp bulbs and similarly thin glass articles which consists in chemically etching the same to produce a white appearing surface and afterwards subjecting the same to the action of an etching reagent without destroying the white appearance thereof.

4. The method of inside frosting lamp bulbs and sim-

ilarly thin glass articles which consists in chemically etching the same to produce a white appearing surface, then washing the same and afterwards subjecting the same to the action of an etching reagent without destroying the white appearance thereof..

Insert 64

5. The method of inside frosting lamp bulbs and similarly thin glass articles which consists in etching the same by means of a fluorine containing reagent to produce a white appearing surface and afterwards subjecting the same to the action of an etching reagent without destroying the white appearance thereof.

Insert 65

6. The method of inside frosting lamp bulbs and similarly thin glass articles which consists in etching the same by means of a fluorine containing reagent to produce a white appearing surface and afterwards subjecting the same to the action of an etching reagent containing fluorine without destroying the white appearance thereof.

Insert 66

7. An article composed of glass having a thickness similar to that of incandescent lamp bulbs and having its inner surface covered with minute rounded etching pits or depressions.

Insert B'

8. An incandescent electric lamp bulb having its inner surface covered with minute rounded etching pits or depressions.

Insert B²

A R G U M E N T

The claims have been cancelled with a view to expressing more clearly the invention. It is believed the claims distinguish from Wood. Wood apparently had no idea of a strengthening treatment. Apparently he was interested merely in the production of a practically colorless glass which would not be desirable in the case of incandescent lamps because it would not cut down the

glare sufficiently. The very meager reference to incandescent lamps in the Wood specification is ambiguous. It is not even apparent that he intended to apply his etching process directly to the lamp bulb. He gives no indication that his process could be applied to the inside etching. Wood's invention is apparently quite a restricted one. In some way or other he first produces pits in the surface of the glass which are widely separated. He then applies his acid to round these out. In the applicant's case, the ordinary etching such as shown in Figs. 1 and 2 of Wood, is first produced and then this is given a treatment. Wood does not do this. He discards the old etching entirely. As stated in his specification, his product appears black before a dark back-ground and resembles ordinary untreated glass. This is quite different from the applicant's invention.

Respectfully submitted,

Attorney for Applicant.

[illegible]ectady, N. Y.
[illegible]t 24, 1925.

Plaintiff's Exhibit P-24

Div. 24 Room 240-ARRAX

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

HEW/tr

Jan. 12, 1926.

Please address all communications from the EXAMINER in charge of the application to

Thomas E. Robertson
Commissioner of Patents

Alexander D. Lunt,
C/o General Electric Co.,
Schenectady, N. Y.

Applicant: H. Pipkin

Ser. No. 690672
Filed Feb. 4, 1924
For Frosted Glass Articles and Methods of Making Same.

MAILED

JAN 12 1926

Responsive to amendment filed Aug. 25, 1925.

The requirement of a drawing is repeated.

Claims 1 to 6 are rejected on Wood of record. An otherwise old process is not new because newly applied to a different material. If such application produces an article having novel and patentable features, the invention lies wholly in the article.

Claims 7 and 8 are rejected as not defining invention over Wood of record. The novel feature of the invention, i.e. the thermal strength does not appear in the claim. In interpreting the scope of these claims attention is called to In re Ivy 331 O.G. 488.

C. L. Williams
Examiner.

PAPER AND AMENDMENT

DEC 1926 ATTORNEY

IN THE UNITED STATES PATENT OFFICE

In re Application of
MARVIN PIPKIN,
Serial No. 690,672,
Filed February 4, 1924,
Div. 51 - Room 240 - Annex.

FROSTED GLASS ARTICLES AND METHODS OF MAKING SAME.

Hon. Commissioner of Patents,
Washington, D. C.

PATENT OFFICE DEC 21 1926 DIV 51

Sir:

In response to Office Action of January 12, 1926, please amend the above-entitled case as follows:

Claim 7, line 5, cancel the "period" after "depressions" and insert of such character and number as to give said article a whitish appearance, said article having comparatively great strength to resist breakage by impact.

Claim 8, line 2, after "depressions" cancel the "period" and insert of such character and number as to give said bulb a whitish appearance, said bulb having comparatively great strength to resist breakage by impact.

ARGUMENT

Reconsideration is requested of the rejection of Claims 1 to 6 on Wood. Each of these claims refers to the initial etching of the bulb or thin glass article on the inside thereof and in such a way as to produce a white appearing surface. In the first place the Wood process is not applied to

bulbs or similarly thin articles. Moreover, this treatment results in forming on the glass surface a multiplicity of minute pits separated by a plane relatively wide as compared with the depth of the pits. In fact, he states that the effect is to produce a very slight cloudiness which is scarcely noticeable. The applicant produces a white appearing surface and of course he does not have the wide separation of the pits specified by Wood.

Claims 7 and 8 have been amended to include the feature of the strength of the bulb or other article, and are believed to distinguish clearly over Wood.

Respectfully submitted,

Alexander Lamb

Attorney for Applicant.

Schenectady, N. Y.
December 17, 1926.

Class 84 Number 41-A

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

C.A.S./jmk

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

May 4, 1927

Applicant: Marvin Pipkin

Ser. No. 690,672
Filed Feb. 4, 1924
For Frosted Glass Articles and Methods of Making Same

Alexander J. Lunt,
C/o General Elec. Co.,
Schenectady, N.Y.

MAILED
MAY 4 1927

Responsive to amendment filed Dec. 20, 1926.

Upon reconsideration, the claims in this case are all rejected as involving new matter unsupported by the application as originally filed. Nowhere in the specification or claims as they then appeared, is it mentioned that the frosting produced a white appearance of the bulb. Since applicant deems the whitening effect of material importance, such effect should have been originally disclosed. If it is in fact an effect produced by all chemical etching, then of necessity it is produced as a result of the Kennedy or Wood processes. If only a few certain etching processes produce that effect so that novelty resides therein, then applicant has failed to make a disclosure so clear that he can base claims to that effect thereupon, and he cannot at this time hope to amend his specification to warrant such claims.

It is noticed that applicant points out nothing more in his claims than the process and product of several successive and apparently duplicate etching steps which in the absence of recitation of new result fail to define over the references of record. Without invention, the bulb in Wood might be etched a second time, thus anticipating applicant's claims.

The claims are accordingly again rejected as in the previous office action, and the remarks as to the probably patentable product are repeated.

THIS ACTION MUST BE RESPONDED TO WITHIN SIX [redacted]

Plaintiff's Exhibit P-24

Ser. No. 690,672. Sheet #2.

A prompt response is urged in view of the long pendency of the case.

Examiner.

U.S. PATENT OFFICE
OCT 17 1927

IN THE UNITED STATES PATENT OFFICE

1927 PATENT OFFICE

In re application of	
MARVIN PIPKIN,	
Serial No. 690,672,	FROSTED GLASS ARTICLES AND
Filed February 4, 1924,	METHODS OF MAKING SAME
Div. 54 - Room 241 - Annex.	

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

Please file the accompanying affidavit in this case.

In response to Office Action of May 4, 1927, please amend the above-entitled case as follows:

Page 1, line 10, cancel "articles" and substitute envelopes

Claim 1, line 4, after "reagent" insert which will round out the pits in the said surface

Claim 2, line 5, after "reagent" insert which will round out the pits in the said surface

Claim 3, line 4, after "reagent" insert which will round out the pits in the said surface

Claim 4, line 5, after "reagent" insert which will round out the pits in the said surface

Claim 5, line 5, after "reagent" insert which will round out the pits in the said surface

Claim 6, line 5, after "reagent" insert which will round out the pits in the said surface

Claim 7, line 1, cancel "article" and substitute envelope

A R G U M E N T

Reconsideration is requested of the rejection of the claims in this case. The affidavit of Mr. Pipkin is believed to establish that the degree of frosting obtained by the practice of the specific process disclosed in his application always produces a white appearing bulb or other glass envelope. Of course Wood was not interested in such a result and in his specification very clearly distinguishes from it. In fact in his drawing he shows the old type of frosting which would produce the white appearance and in which we are interested, and distinguishes his process and product therefrom. Moreover, Wood's is not a process for inside frosting or frosting articles such as bulbs. Such a treatment as that described by Wood would be absolutely unsuitable for bulbs if it could be applied at all, which is extremely doubtful. Ofcourse the applicant would be glad to use any language which might be suggested which would be more descriptive of the result which is produced, but the whitish appearance is certainly a very striking characteristic of frosts which are practical for electric lamp bulbs.

The method claims have been amended to express a characteristic feature of the applicant's process. The applicant's strengthening treatment rounds out the sharp angled pits which are formed by the first frosting treatment. This distinguishes from the process which would simply mean the repetition of the first frosting treatment. Such a repetition would merely produce more of the sharp angled pits. The character of the applicant's strengthening solution and the elements of time and temperature are such that this effect is produced. It is to be noted that in the specific example given the applicant utilizes

an entirely different solution for the strengthening treatment than that used for the frosting, but it is also stated that a frosting solution can be used if it is diluted greatly as by removing the frosting solution and then filling the bulb with warm water.

Respectfully submitted,

Alexander D Lunt

Attorney for Applicant.

Schenectady, N. Y.
October 12, 1917.

Z90672

STATE OF OHIO :
: ss.
COUNTY OF CUYAHOGA :

MARVIN PIPKIN, being duly sworn, deposes and says:

That he is the applicant named in United States patent application Serial No. 690,672 filed February 4, 1924;

That prior to February 4, 1924 the process specifically set forth in the specification of said application was practiced to produce hundreds of bulbs frosted on the inside thereof, and that in all cases the bulb after the frosting treatment and strengthening treatment specifically disclosed in said application had the decidedly whitish appearance characteristic of inside frosted lamps now on the market; and

That the process specifically described in said application could not be applied to the inside frosting of bulbs without giving them a whitish appearance.

Further affiant sayeth not.

Marvin Pipkin

Subscribed and sworn to before me by the said Marvin Pipkin, this 7th day of October, 1927.

Donna B. Pendron
Notary Public

Div. 54 Room 241-E Elder-E Paper No. 8

Address only "The Commissioner of Patents, Washington, D. C." and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE,
WASHINGTON

All communications regarding this application should give the serial number, date of filing, and name of the applicant

Please find below a communication from the EXAMINER in charge of this application.

March 20, 1928.

Thomas E. Robertson
Commissioner of Patents.

a 5 o 11—8023

Applicant: Marvin Pipkin.

A. D. Lunt,
General Electric Co.
Schenectady, N.Y.

MAR 20

Ser. No. 690672
Filed
For Feb. 4, 1924
Frosted Articles.

Responsive to amendment filed Oct. 14, 1927:

All the claims are rejected as drawn to new matter. Applicant is relying on the whitish appearance to avoid the Wood reference. This appearance was not disclosed in the specification, as originally filed. It is not seen how applicant can include this disclosure in his application for to use a supplemental oath under Rule 48, applicant must have originally shown or described the feature in question. Such a disclosure was not made in this application.

The claims are further rejected on Wood. Wood preliminarily etches his glass, andwhether he does it by chemical or mechanical means makes no difference so far as result is concerned. By this treatment, he gets jagged edges. These edges he rounds by an application of hydrofluoricacid. The results of each step are the same as applicant's. Hence the product is the same.

C. F. Law

Examiner.

Plaintiff's Exhibit P-24

MAIL DIVISION
APR 12 1928

POWER OF ATTORNEY

IN THE UNITED STATES PATENT OFFICE

In re Application of

Marvin Pipkin

Ser. No. 690,672.

Filed February 4, 1924.

Div. No. 54 Room No. 241-A

FROSTED GLASS ARTICLES AND METHOD OF MAKING SAME

To The Honorable Commissioner of Patents:

General Electric Company, assignee of the entire right, title and interest in and to the above application, hereby revokes all previous powers of attorney and appoints Charles E. Tullar, whose address is c/o General Electric Company, Schenectady, New York, its attorney, with full power of substitution and revocation, to prosecute the said application, to make alterations and amendments therein, to receive the patent and to transact all business in the Patent Office connected therewith.

GENERAL ELECTRIC COMPANY,

By Albert G. Davis

Vice President.

Schenectady, N. Y.,

April 5, 1928.

Accepted

APR 18 1928

J. E. Robertson

Commissioner.

Plaintiff's Exhibit P-24

#10

KEG

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

April 24, 1928.

Charles E. Tullar,
c/o General Electric Co.,
Schenectady, N. Y.

Applicant Marvin Pipkin

Serial No. 690,672

Filed Feb. 4, 1924

For Frosted Glass Articles and Methods of Making Same.

In this case your power of attorney has been accepted.

revoked by assignee.

Respectfully,

Thomas E. Robertson
Commissioner.

Revoking power of attorney

to

Alexander D. Lunt,
c/o General Electric Co.,
Schenectady, N. Y.

Plaintiff's Exhibit P-24

U. S. PATENT OFFICE
PATENTS 11

SEP 8 1928

IN THE UNITED STATES PATENT OFFICE

DIVISION 54

In re Application of
MARVIN PIPKIN,
Serial No. 690,672,
Filed February 4, 1924,
Div. 54 - Room 241 - Annex.

FROSTED GLASS ARTICLES AND METHODS OF MAKING SAME

MAIL DIVISION SEP 6 28 U.S. PATENT OFFICE

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

This is in response to Office Action of March 20, 1928.

In view of the allowance of the applicant's continuation application, Serial No. 40,152, filed June 29, 1925, the claims of which are deemed to be sufficient for the protection of the applicant's invention, the applicant is not desirous of continuing the prosecution of the present application. However, the applicant wishes to make it clear that he does not agree with the Examiner in the rejection of the last Office Action in this case. In the specification the applicant disclosed a process specifically, the effect of which when applied to a glass bulb is to etch the inner surface thereof to such an extent as to give the bulb a distinctly whitish appearance and the strengthening treatment does not remove this whitish appearance. It is true that it was not specifically stated in the specification that the bulb had this whitish appearance, but as the affidavit of the inventor showed, this process could not be applied without producing the whitish appearance. Therefore the specification contained a disclosure which is believed to be sufficient to warrant the use of this descriptive expression.

It is believed to be unnecessary to discuss the rejection on the reference Wood in view of the allowance of the applicant's continuation case. Moreover, such claims as 7 and 8 of the present application, especially in view of the reference to the whitish appearance, are certainly not affected by the disclosure in the Wood patent. As a matter of fact, the

method claims are not believed to be met by Wood but this matter of the claims has become a moot question in view of the fact that the applicant has decided to rely on the claims allowed in the continuation application.

Respectfully submitted,

Charles E. Tulla

Attorney for Applicant.

Schenectady, N. Y.

September 5, 1928.

JAH'EBC.

Plaintiff's Exhibit P-24

EXAMINER IN CHANCERY
NOTARY PUBLIC
TESTIMONY AND PATENT WORK

MISS E. H. PARKINS
McGILL BUILDING
908-914 G STREET NORTHWEST
WASHINGTON, D. C.

NEW ADDRESS
1399 NATIONAL PRESS BLDG.

January 11, 1933

Commissioner of Patents,
Washington, D. C.

Sir:

I respectfully request permission to inspect and make copies of abandoned file, Serial No. 690,672, filed February 4, 1924, which is referred to in Pipkin, Patent No. 1,687,510.

Respectfully,

E. H. Parkins

EHP/mem

DIVISION
APR 10 1933
U. S. PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE

In the Application of
MARVIN PIPKIN
Serial No. 690,672
Filed February 4, 1924
For: Method of Inside Frosting Incandescent Lamps (Abandoned Application)

PETITION

Hon. Commissioner of Patents
Sir:

Your petitioner request that permission be granted to inspect and make copies of the papers, etc., in the above noted abandoned application for the following reasons.

Suit has been brought on Pipkin patent No. 1,687,510 in United States District Court, Southern District of California, Central Division, General Electric Company vs. T. Anraku trading under the fictitious name and style of Tykoyo Lamp Company and/or trading under the fictitious name and style of Metropolitan Trading Company in Equity No. Y-31-J.

The aforesaid patent states that this application is a "continuation in part of my application Serial No. 690,672, filed February 4, 1924."

In the interests of determining defendant's equity in this suit an examination of the original application which has become abandoned is important.

Wherefore petitioners respectfully pray that petition for access to the application file above noted be granted.

Respectfully,

TOWNSHEND & TOWNSHEND

April 10, 1933

Plaintiff's Exhibit P-24 19[illegible]

ERICH FRAENKEL
DIPL.-ING.

ATTORNEY'S ROOM
APR 8 1938
U.S. PATENT OFFICE

DOCKET ROOM
APR 8 - 1938
U.S. PATENT OFFICE

IN THE UNITED STATES PATENT [illegible]

Paper No. 18

To the Commissioner of Patents,
Washington, D.C.

Sir:

In connection with U. S. patent No. 1,687,510, dated Oct. 16, 1928, to Marvin Pipkin, I hereby request authorization to inspect the file of said patentee's then co-pending application, now abandoned or forfeited, Serial No. 690,672, filed February 4, 1924, for an improvement in frosted glass and articles and method of making the same.

The reason for this request is that, upon inspecting the file of said patent No. 1,687,510, I find that reference was made to the parent application Serial No. 690,672 referred to above. This reference appears in the attorney's letter of May 25, 1928, wherein he refers to the co-pending application for further description and disclosure of matter discussed in the patent file, having reference to the divisional subject matter for which said patent was granted. It is impossible to fully or satisfactorily understand the subject matter of the patent without reference to the aforementioned application, as the remarks of the attorney of record indicates.

Respectfully,

Erich Fraenkel

Address: care Dowell & Dowell,
McLachlen Building,
Washington, D.C.

4-6-8
U.S. Patent Office

Plaintiff's Exhibit P-21

690672 - 14

1,687,510
Lawson

DOCKET DIVISION
THE COMMISSIONER OF PATENTS
WASHINGTON, D. C.
JUN 12 1933
U. S. PATENT OFFICE

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

(Date) June 12/33

THE COMMISSIONER OF PATENTS.

Sir:

Please furnish Gaut access to abandoned application of Marvin Lipkin Ser No 690672 filed 2/4/24, of which Pat 1687510 is a continuation in part.

Note in the pat. pg 1 l 3-5, and pg 3 l 127-128, that reference is made to the abandoned application & to the fact that said patent is a continuation in part.

Respectfully,
Gaut & Wilcox

O.K.
A.P. Johnson
6/12/33

(Give full address)

Cost, $

Received, $

Delivered , 19

RALPH B. STEWART
ATTORNEY AT LAW
PATENT AND TRADE MARK CAUSES
NATIONAL PRESS BUILDING,
WASHINGTON D. C

NOV 25 1936
MAIL ROOM
NOV
U S PATENT OFFICE

November 24, 1936.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

The application which matured into U. S. Patent to Sipkin 1,687,510 is stated to be a continuation in part of an earlier application Ser. No. 690,672, filed February 4, 1924. The undersigned requests access to said earlier application for the purpose of determining the history of the Sipkin patent.

Very truly yours,

Ralph B. Stewart

O.K.
A. P. Patterson
11-25-36

ATTORNEY'S ROOM
DEC 14 1936
U.S. PATENT OFFICE

Paper No. 16
December 14, 1936

Commissioner of Patents,
Washington D. C.
Sir

respectfully request permission to inspect abandoned file, Serial No. 690,672, filed February 7, 1924, referred to in Pipkin, patent No. 1,687,510 and to make copies thereof

Respectfully
W. Faulkner
Atty.

Approved
Dec. 14 1936

ADDRESS ONLY THE COMMISSIONER OF PATENTS WASHINGTON, D. C.

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

(Date) Jan. 4, 1938

THE COMMISSIONER OF PATENTS.

Sir:

~~Please furnish~~ Patent #1,687,510 was issued to Morris Pinchon on Oct. 16, 1928 from an application S.N. 40,152 filed June 29, 1925.

In the first paragraph of the patent, the following appears:-

"This application is a continuation in part of my application Serial No. 690,672 filed February 4, 1924"

The undersigned hereby requests permission to inspect the file of the said application S.No. 690,672 and to obtain photostatic copies of the said application file.

The said application S.No. 690,672 has become and now stands "abandoned"

Thomas and Thomas,
By 114

(Give full address)

OIC 1/4/37
O.A. Robinson

Cost, $

Received, $

Delivered 19

Plaintiff's Exhibit P-24

Kurt H.Feist
[redacted] Street
New York City

DOCKET DIVISION
JUN 14 1938
U.S. PATENT OFFICE

June 13, 1938

Feist Ser. No. 19

ATTORNEY'S ROOM
JUN 14 1938
U.S. PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE

To the Commissioner of Patents,
Washington, D.C.

Sir:

In connection with U.S. patent No. 1,687,510, dated Oct. 16,1928, to Marvin Pipkin, I hereby request authorization to inspect and copy the file of said patentee's then co-pending application, now abandoned or forfeited, Serial No. 690,672, filed February 4,1924, for an improvement in frosted glass and articles and method of making the same.

The reason for this request is that, upon inspecting the file of said patent No. 1,687,510, I find that reference was made to the parent application Serial No. 690,672 referred to above. This reference appears in the attorney's letter of May 28, 1928, wherein he refers to the co-pending application for furgther description and disclosure of matter discussed in the ~~in the~~ patent file, having reference to the divisional subject matter for which said patent was granted. It is impossible to fully or satisfactorily understand the subject matter of the patent without reference to the afore mentioned application, as the remarks of the attorney of record indicates.

Respectfully,

Kurt H. Feist

6/6 June 14/38
W. F. Robinson

2—421

1924

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2.	[illegible]	27.	
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		50.	

DEFENDANT'S EXHIBITS

NUMBER (Series of 1920), 40152

1925

DIV. 54

PATENT No. 1687510

OCT 16 1928

Name MARVIN [illegible]

Assn to General Electric Co.
Emp. of Hayes Lunt.

UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY
EXHIBIT
SEP 24 1931
D-1

of CLEVELAND HEIGHTS

State of OHIO

Invention ~~Thin Diffusing Glassware~~
~~INSIDE FROSTED GLASS ARTICLES~~

ORIGINAL	RENEWED
APPLICATION FILED COMPLETE JUNE 29, 1925	
Petition, Specification, Oath, First Fee, $30, Sheets Drawings, JUNE 29, 1925	Date of Execution November 27, 1928.
Basis June 29 1925	
Examined and passed for Issue June 8, 1928	, 19
Ex. Div. 54	Ex. Div.
Date of Allowance June 12, 1928	, 19
Final Fee $30 Rec'd July 1, 1928	By Commissioner, , 19
Patented, Charles E. Fuller	, 19
Attorney ~~ALEXANDER B. LUNT~~ C/O GENERAL ELECTRIC CO SCHENECTADY N Y	OCT 16 1928

Claims allowed 2-0 Print Claims 1 In O.G. Oct. 16

Electrical glass [illegible]

RECD JUN 29 1934 U.S. PAT. OFFICE

40152

PETITION

PATENT OFFICE JUL 2 1935 DIV. 8

TO THE HONORABLE COMMISSIONER OF PATENTS:

Your petitioner, Marvin Pipkin,

a citizen of the United States, residing at Cleveland Heights,

in the County of Cuyahoga, State of Ohio,

whose Post Office address is No. 3815 Parkdale Ave., Cleveland Heights, Ohio,

prays that Letters Patent may be granted him for the improvement in

INSIDE FROSTED GLASS ARTICLES.

(Docket No. 35,797)

set forth in the accompanying specification.

And he further prays that you will recognize Mr. Alexander D. Lunt, of Schenectady, New York, as his attorney, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Marvin Pipkin

N/2

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN, that I, Marvin Pipkin, a citizen of the United States, residing at Cleveland Heights, in the County of Cuyahoga, State of Ohio, have invented certain new and useful improvements in ~~INSIDE FROSTED GLASS ARTICLES~~, of which the following is a specification:

My invention relates to ~~frosted glass articles~~ and to methods and apparatus for ~~frosting them~~. More particularly it relates to ~~frosted~~ bulbs and other similarly thin glassware which ~~is~~ used for electrical and illuminating purposes. This application is a continuation in part of my application, Serial No. 690,672, filed February 4, 1924.

~~My invention comprises~~ An important feature of my invention is an improved method of frosting bulbs and other thin glassware on the inside. Inside frosting has advantages over outside frosting. This is particularly true in the case of illuminating glassware since better diffusion with lower absorption of light is obtained. Another advantage of the inside frosting, which applies generally, is that the outer surface of the article is left smooth and, therefore, does not collect dirt easily and may be easily cleaned. There are other instances where inside frosting is desirable to improve the appearance or to perform other functions in the operation of the device. The preferred method of frosting is by removal of material, that is, by etching, rather than by application of coatings. However, as heretofore produced, bulbs and similarly thin articles thus frosted on the inside have been fragile to such a degree as to occasion prohibitive breakage. Bulbs ordinarily used for incandescent lamps are between 12 and 90 mils in thickness, averaging between 15 and 70 mils, and apparently, the application of the inside frost by etching has weakened them so that they have been very easily broken

40152-B

~~While my~~ invention applies particularly to such bulbs, it ~~is not limited thereto as it may be applied to advantage in frosting thicker articles.~~ The object of my invention is to produce an inside frosted glass ~~article~~ bulb which will be much stronger than those heretofore produced.

The prior art makes no distinction between the methods of inside and outside frosting. The frosting on the outside has been accomplished by sand blasting or by the use of a chemical frosting medium. Frosting by etching is to be distinguished from the etching without frosting as the former produces a fine grained rough surface which appears more or less white while such etching without frosting produces a surface which is substantially colorless. The unfrosted etched glass is not sufficiently diffusing for lamp bulbs. The preferred method of frosting is by the use of a chemical medium. For lime glasses the presence of an ammonium compound in addition to the hydrofluoric acid seems to be necessary. The effect is improved by the addition of finely divided inert materials such as barium sulphate. In some cases the presence of sodium salts such as sodium sulphate is of advantage. Dextrin or flour may also be added in order to cause better adherence of the mixture to the glass surface. The degree of frosting depends upon three factors; first, the strength of the frosting mixture as indicated by the percentage of hydrofluoric acid present; second, the temperature of the mixture; and third, the time during which the bulb is exposed to the frosting mixture. Ordinarily the stronger the mixture, the higher the temperature, and up to a certain point, the longer the time, the greater the degree of frosting. When the inside surface of a lamp bulb is subjected to these frosting mixtures to the extent necessary to produce a practical frost, that is, one

No. 52-3

which will produce the proper light diffusion, the article becomes extremely fragile. I have found, however, that if the bulb is given a further treatment, which I term a strengthening treatment, in which it is subjected to an etching or frosting treatment of lower degree than that to which it was first subjected, it becomes quite strong. Indeed, it may be made practically as strong as the original clear glass bulb. The use of a weaker etching medium for the treating step is preferable to lessening the time or temperature. An etching solution becomes weaker with use and so, good results may be sometimes secured by using, for the strengthening treatment, the used frosting solution.

In the drawing, Fig. 1 is a diagram showing the effect of inside frosting on the strength of a bulb; Fig. 2 is a diagram showing the results of the strengthening treatment comprised by my invention; Fig. 3 is a diagram showing the effect of the strengthening treatment on the strength, the light absorption and the diffusion of the bulb; Fig. 4 is a diagram showing the variation of the various sizes of lamps in maximum brightness; Fig. 5 is a diagram showing the variation in absorption; Fig. 6 is an elevation of a bulb strength tester; Fig. 7 is a plan and Fig. 8 is an elevation partly in section of an apparatus for applying the frosting and strengthening treatments.

In Fig. 1 the ordinates represent the strength of the bulb as determined by the ivory ball tester hereinafter described. The abscissae represent the time in minutes during which the inside of the bulb is subjected to the frosting mixture. There are two curves. In obtaining curve No. 1, the following frosting mixture was used:

Ammonium bi-fluoride	36
Dextrin (powder)	10
Barium sulphate	28
Sodium bi-sulphate	5
Water	21

This mixture contained 11.9% hydrofluoric acid. The temperature was 20° Centigrade. For test No. 2 the above mixture was diluted with water and the mixture used was constituted as follows:

Ammonium bi-fluoride	25%
Dextrin	6.9%
Barium sulphate	19.3%
Sodium bi-sulphate	3.45%
Water	45.35%

The temperature was 20° Centigrade. The frosting mixture contained 8.36% hydrofluoric acid. In test No. 1 and test No. 2 a fresh solution was used in each bulb frosted. In both cases the mixture was poured into dry bulbs and allowed to remain for the time specified. In test No. 1 five sets of bulbs were tested, each set containing five bulbs. The tests were made at zero, one minute, five minutes, ten minutes and twenty minutes. The average showed an initial strength of 44.8; 9.8 after one minute; 2.8 after five minutes; 2.2 at ten minutes and about the same at twenty minutes. The bulbs which were frosted for one minute did not have enough frosting to make them practical for use. In test No. 2 a similar number of bulbs were tested and the average was 44.8 at zero; 42.2 at five minutes; 13.0 at ten minutes; 4.2 at twenty minutes and 2.6 at twenty-five minutes. The bulbs frosted for five minutes were almost like clear bulbs. Those for ten minutes had just a slight haze but were unsuitable for use in lamps.

A bulb having a strength less than 7, which is about 16% that of the clear bulb, would be too fragile for handling commercially. In practice it is aimed to keep the strength above 20 or about 45% that of the clear bulb. It is apparent therefore from the above test results that when the frost was sufficient to produce practical diffusion, the bulb was prohibitively weak.

40152-5

Fig.2 shows the effect of the strengthening treatment comprised by my invention. The frosting mixture used had an acidity of 11.8% hydrofluoric acid and the temperature was 50° Centigrade. The mixture was sprayed over the inside of the bulb for five seconds, and after five seconds it was sprayed again and this continued for the period of the test. The time is indicated in seconds and represents the time during which the frosting mixture was in contact with the bulb. The clear bulbs were washed out with water at about 45° Centigrade just before being sprayed. The curve marked "Frosting" was derived from five sets of bulbs of five bulbs each. The average showed a strength of 44.8 at zero; 11 at ten seconds; 4.8 at twenty seconds; 3 at thirty seconds, and so on as indicated in the full line curve. The bulbs frosted for ten seconds had only a slight haze and were unsuited for practical use. Those frosted for twenty seconds were not uniform. Those at thirty seconds were better, and from then on the bulbs were suitable.

In Fig. 2 the broken line curve marked "Treating" was derived from the results of tests in which five sets of bulbs of five each were used. The bulbs treated had been frosted and showed an average strength of 5.2 on the ivory ball tester. The mixture used contained 7.44% hydrofluoric acid, 40% barium sulphate and 8% dextrin. The procedure followed was the same as followed in the case of the frosting i.e. the mixture was sprayed over the interior surface of the bulb. The curve shows that the initial strength was 5.2; that after thirty seconds treatment the strength was 39.6; and that after this time the strength rose to substantially the same as that of the clear bulb. It has been found in practice that thirty seconds under these conditions is a desirable period and the curve shows that during this time the strength increased from 5.2 to 39.6, or 1157%.

H815

In order to obtain comparative information regarding the effect of exterior and interior frosting, tests were conducted in which a uniform selection of lime glass bulbs was made. These were divided into two portions. One portion was frosted inside and the other on the outside. Of the portion which was frosted on the inside some were given the strengthening treatment and some were not, and the amount of the strengthening treatment was varied. The strength tests were obtained from samples and lamps were made from the remaining bulbs. The lamps were the ordinary tungsten 115 volt, 40 watt lamps of the vacuum type and made according to standard practice. Photometric tests were then made of the lamps so as to determine the maximum brightness in candles per square centimeter which indicates the amount of diffusion. The absorption by the bulb was also determined the loss in lumens being expressed in percentage. The results showed the average for the clear bulbs to be strength 44.8; absorption 0; and maximum brightness 201.8. Lamps frosted on the outside showed strength 44.8; absorption 5.13; and maximum brightness 5.56. Lamps frosted on the outside for a longer time showed strength 44.8; absorption 3.96; and maximum brightness 5.4. Lamps frosted on the inside but which were not given the strengthening treatment showed strength 6.8; absorption 2.25; and maximum brightness 5.02. Lamps frosted on the inside and given the strengthening treatment comprised by my invention for ten seconds showed strength 30.4; absorption 1.22; and maximum brightness 4.5. Those treated for twenty seconds showed strength 42; absorption 1.27; and maximum brightness 5.6. Those treated for forty seconds showed strength 44.8; absorption 1.07; and maximum brightness 5.92. These results indicate that the inside frosted lamps have greater diffusion and lower absorption than the outside frosted lamps. They also indicate

that by the strengthening treatment the strength is brought up so that the lamp can be practically handled, and that while the maximum brightness is increased, or in other words, the diffusion is reduced, still the absorption is lessened. Moreover, the diffusion is substantially as good as that of the outside frosted lamps.

Fig. 3 is a diagram showing the effect of treating. Curve I shows the strength, curve 2, the absorption and curve 3 the maximum brightness. The treating solution had an acidity of 5.2% hydrofluoric acid and the temperature was 55° Centigrade. These curves indicate that treating enormously increases the strength of the bulb. It increases the maximum brightness somewhat but not to an objectionable extent and at the same time this is compensated for to a certain extent by the lowering of the absorption. The curve shows that, after a treatment of ten seconds, the strength had been increased from 6.8 to 30.4, while the brightness had been increased from 3 to 4.5, and on the other hand the absorption had been lowered from 2.35 to 1.22.

The tests upon which the curves shown in Fig. 4 are based were made to show the relation between the maximum brightness of the inside frosted bulb lamp and the corresponding clear bulb lamp for the various wattages. The curve shows the following values:

Wattage	Maximum Brightness (Clear)	Maximum Brightness (Inside Frosted)	Per Cent
15	176	2.35	1.3
25	261	4.1	1.6
40	259	5.2	2.0
60	596	9.2	1.5
100	632	12.5	2.0
100 (Daylight)	269	6.4	2.4
200	807	19.9	2.6
500	925	39.0	4.2

These tests indicate that for ordinary incandescent lamps, the average maximum brightness for inside

frosted lamps, frosted according to my invention, is below 4.5% of that of the clear bulb lamp of the same wattage. Heretofore bulbs inside frosted so that the maximum brightness of the frosted lamp was below fifty per cent of that of the clear bulb lamp had a strength below 16% of that of the clear bulb.

The full line curve in Fig. 5 shows the output in lumens of the clear bulb lamp and the dotted line shows the same for a lamp having a bulb inside frosted by my invention. The small percentage loss in lumens caused by the inside frost will be apparent.

In obtaining the curves of Figs. 1, 2 and 3, the measurement of strength of bulb was made by means of the ivory ball tester shown in Fig. 6. This device consists of a spring clamped holder 10 adapted to receive and hold securely a bulb 11. The holder and bulb are suspended as by means of a chain 12 so as to allow them to swing. The blow is applied by means of an ivory ball 13 which is mounted on a rod 14 pivotally suspended at 15 to the frame 16. The force of the blow delivered by the ivory ball depends upon the length of the arc through which it swings. It strikes the bulb through a circular passage in the block 16' into which the bulging portion of the bulb extends. A gauge is provided consisting of an arcuate scale 17 suitably graded and supported from the frame 16 by a suitable bracket 18. A slidable marker 19 provides a guide for the starting of the pendulum swing of the ivory ball in each case.

In Figs. 7 and 8 are shown an apparatus which I have devised for the application of the inside frosting and treating. This apparatus comprises a suitable reservoir 20 surrounded by a water jacket 21 having inlet and outlet pipes 22 - 23. Water may be circulated through the water jacket at a suitable temperature to maintain the frost

mixture contained in the reservoir 20 at the desired temperature. The frosting mixture is forced up through the pipe 24 to the bulb 25 by air pressure applied through the pipe 26. A suitable holder 27 is provided which serves to support the bulb. The surplus frosting mixture returns to the reservoir through the funnel 28 and pipe 29. Fresh solution may also be added through the same means. Conveniently mounted on the same frame 30 as the frosting apparatus is the washing means consisting of the water pipe 31 which projects up above the frame so that the bulb 25 may be placed thereover, said bulb being supported in the holder 32. After the bulb has been frosted it is washed by this means and the overflow goes into a reservoir 33. On the same frame is also mounted the apparatus for giving the bulbs the strengthening treatment hereinbefore referred to. This apparatus, as shown, is a duplicate of the apparatus used for the first frosting. As hereinbefore stated, it is preferred to use a weaker solution in the strengthening mixture reservoir 34 from that used in the frosting mixture reservoir 20.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than fifty per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixteen per cent of that of the clear bulb.

2. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty-five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixteen per cent of that of the clear bulb.

3. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than ten per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixteen per cent of that of the clear bulb.

4. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than five per cent of that of the same lamp with a clear glass bulb and having a strength to re-

sist breakage by impact greater than sixteen per cent of that of the clear bulb.

5. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than fifty per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than twenty-five per cent of that of the clear bulb.

6. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than fifty per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

7. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than fifty per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixty per cent of that of the clear bulb.

8. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than fifty per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than eighty per cent of that of

the clear bulb.

9. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty-five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than twenty-five per cent of that of the clear bulb.

10. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty-five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

11. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty-five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixty per cent of that of the clear bulb.

12. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than twenty-five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than eighty per cent of that of the clear bulb.

And

13. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than ten per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than twenty-five per cent of that of the clear bulb.

14. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than ten per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

15. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than ten per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixty per cent of that of the clear bulb.

16. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than ten per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than eighty per cent of that of the clear bulb.

17. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than twenty-five per cent of that of the clear bulb.

18. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

19. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than sixty per cent of that of the clear bulb.

20. A glass bulb for electric incandescent lamps and similar articles which is inside frosted to such a degree that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such bulb is less than five per cent of that of the same lamp with a clear glass bulb and having a strength to resist breakage by impact greater than eighty per cent of that of the clear bulb.

P.J.C.

1/18 18. The method of strengthening glass bulbs frosted by etching on the inside, which consists in subjecting the inside frosted surface to an etching medium with the conditions of time, temperature and etching strength of the medium such that the treatment is less powerful than that used to produce the frost on the bulb chemically.

2/19 19. The method of inside frosting a bulb which consists in first frosting the inside thereof by etching until the bulb has a distinctly whitish appearance and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that used to chemically produce the original frosting effect.

3/20 20. The method of inside frosting a bulb which consists in first chemically frosting the inside thereof by etching until the bulb has a distinctly whitish appearance and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that of the original frosting treatment.

4/21 21. The method of inside frosting a bulb which consists in first frosting the inside thereof by etching so the maximum brightness of an incandescent lamp comprising said bulb will be less than fifty per cent of that of said lamp with a clear bulb and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that used to chemically produce the original frosting effect.

Alt

22 25. The method of inside frosting a bulb which consists in first frosting the inside thereof by etching so the maximum brightness of an incandescent lamp comprising said bulb will be less than twenty-five per cent of that of said lamp with a clear bulb and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that used to chemically produce the original frosting effect.

23 26. The method of inside frosting a bulb which consists in first frosting the inside thereof by etching so the maximum brightness of an incandescent lamp comprising said bulb will be less than ten per cent of that of said lamp with a clear bulb and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that used to chemically produce the original frosting effect.

24 27. The method of inside frosting a bulb which consists in first frosting the inside thereof by etching so the maximum brightness of an incandescent lamp comprising said bulb will be less than five per cent of that of said lamp with a clear bulb and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such that the etching effect is less powerful than that used to chemically produce the original frosting effect.

Ali

~~15~~ 16. An apparatus for inside frosting bulbs comprising means for supporting a bulb with its neck downward, means for ~~directing a discharge of~~ spraying out etching liquid into said bulb, a reservoir and means for receiving the overflow and for directing the same back to said reservoir.

IN WITNESS WHEREOF, I have hereunto set my hand this 26th day of June, 1925.

Marcus Rifkin

JEA:KER

A F F I D A V I T

STATE OF OHIO :
: SS:
COUNTY OF CUYAHOGA :

MARVIN PIPKIN, the above-named petitioner, being duly sworn, deposes and says that he is a citizen of the United States, and resident of Cleveland Heights, in the County of Cuyahoga, State of Ohio, and that he verily believes himself to be the original, first and sole inventor of the improvements in Inside Frosted Glass Articles described and claimed in the annexed specification; that he does not know and does not believe that the same were ever known or used before his invention or discovery thereof; or patented or described in any printed publication in any country before his invention or discovery thereof.

That as to those features of his said invention not disclosed in his prior application, Serial No. 690,672, filed February 4, 1924, he does not know and does not believe that they were patented or described in any printed publication in any country more than two years prior to this application; or patented in any country foreign to the United States on an application filed by himself or his legal representatives or assigns more than twelve months prior to this application, or in public use or on sale in the United States for more than two years prior to this application; and that no application for patent on said improvements has been filed by him or his representatives or assigns in any country foreign to the United States.

That as to those features of his said invention disclosed in his said prior application he does not

know and does not believe that the same were patented or described in any printed publication in any country more than two years prior to the filing of the said prior application, or patented in any country foreign to the United States on an application filed by himself or his legal representatives or assigns more than twelve months prior to the filing of said prior application, or in public use or on sale in the United States for more than two years prior to the said application, and that no application for patent on said improvements was filed by him or his legal representatives or assigns in any country foreign to the United States prior to the filing of the said application, Serial No. 690,672.

Marvin Pipkin

Sworn to and subscribed before me this 26th day of June, 1925.

Norma B Sheldron
NOTARY PUBLIC.

220a

Defendant's Exhibit D-1

Fig. 1

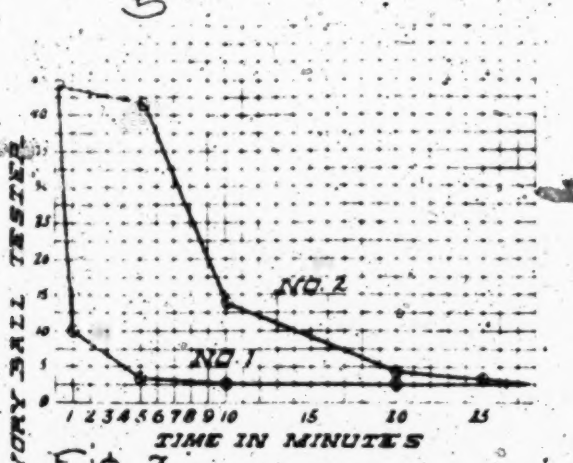


Fig. 2

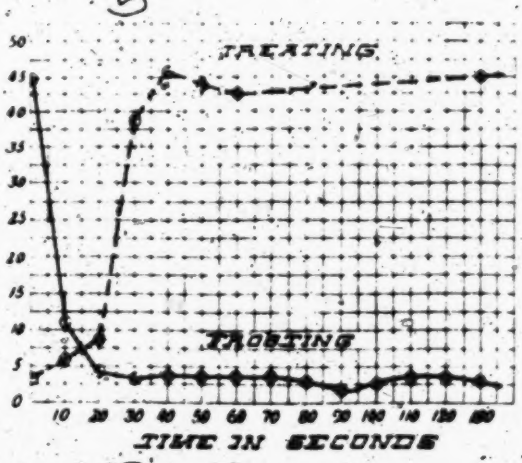


Fig. 3

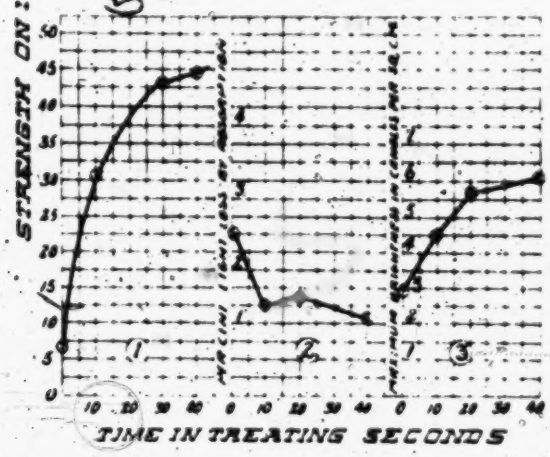


Fig. 4

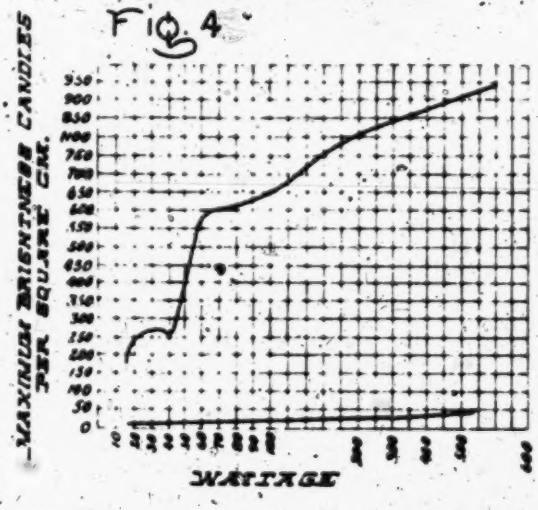


Fig. 6

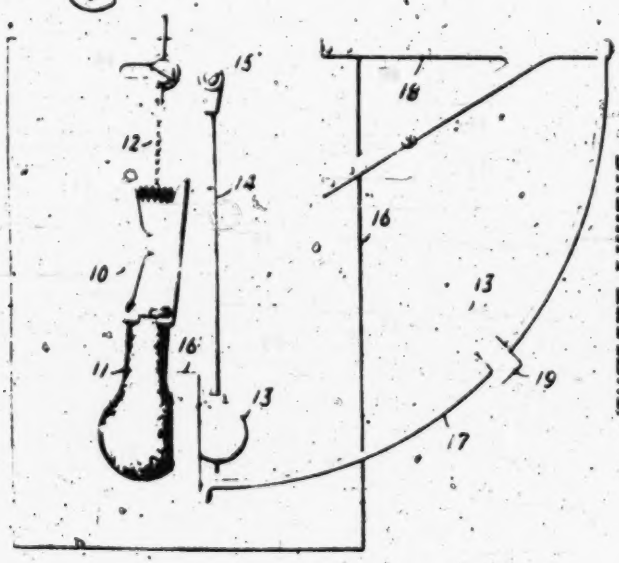
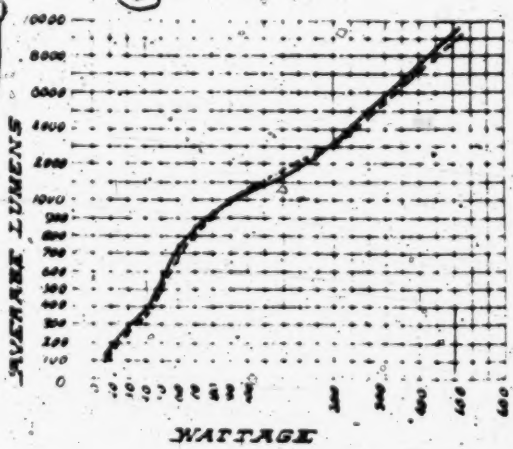


Fig. 5



INVENTOR:
MARVIN EIPKIN,
BY Alexander S. Lane
HIS ATTORNEY.

Fig. 7

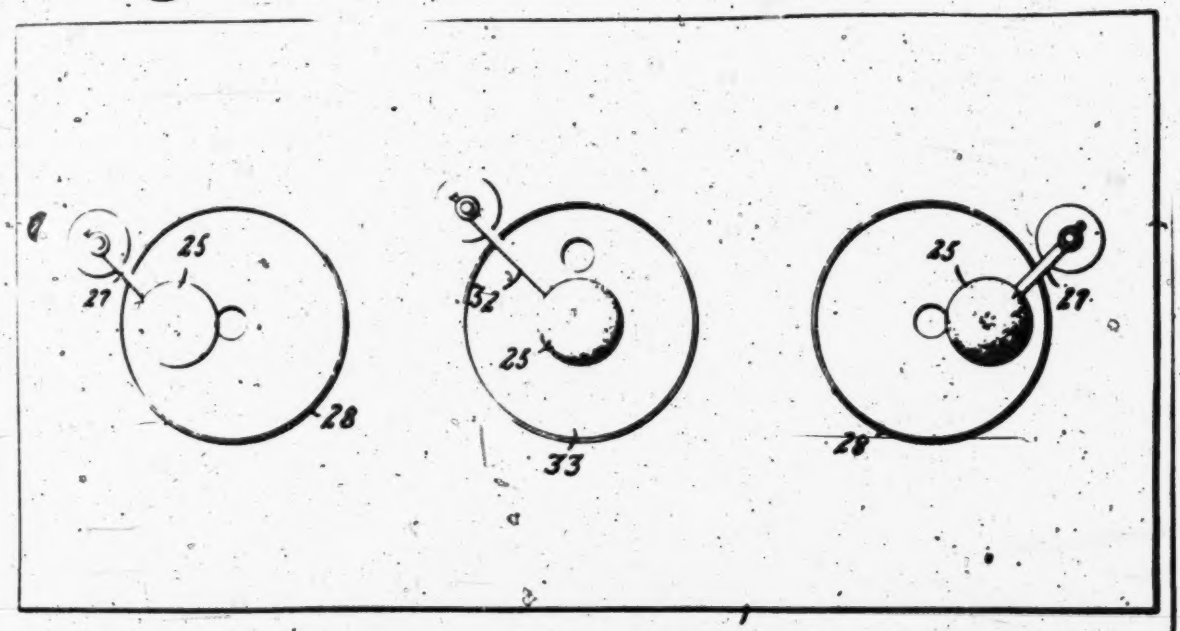
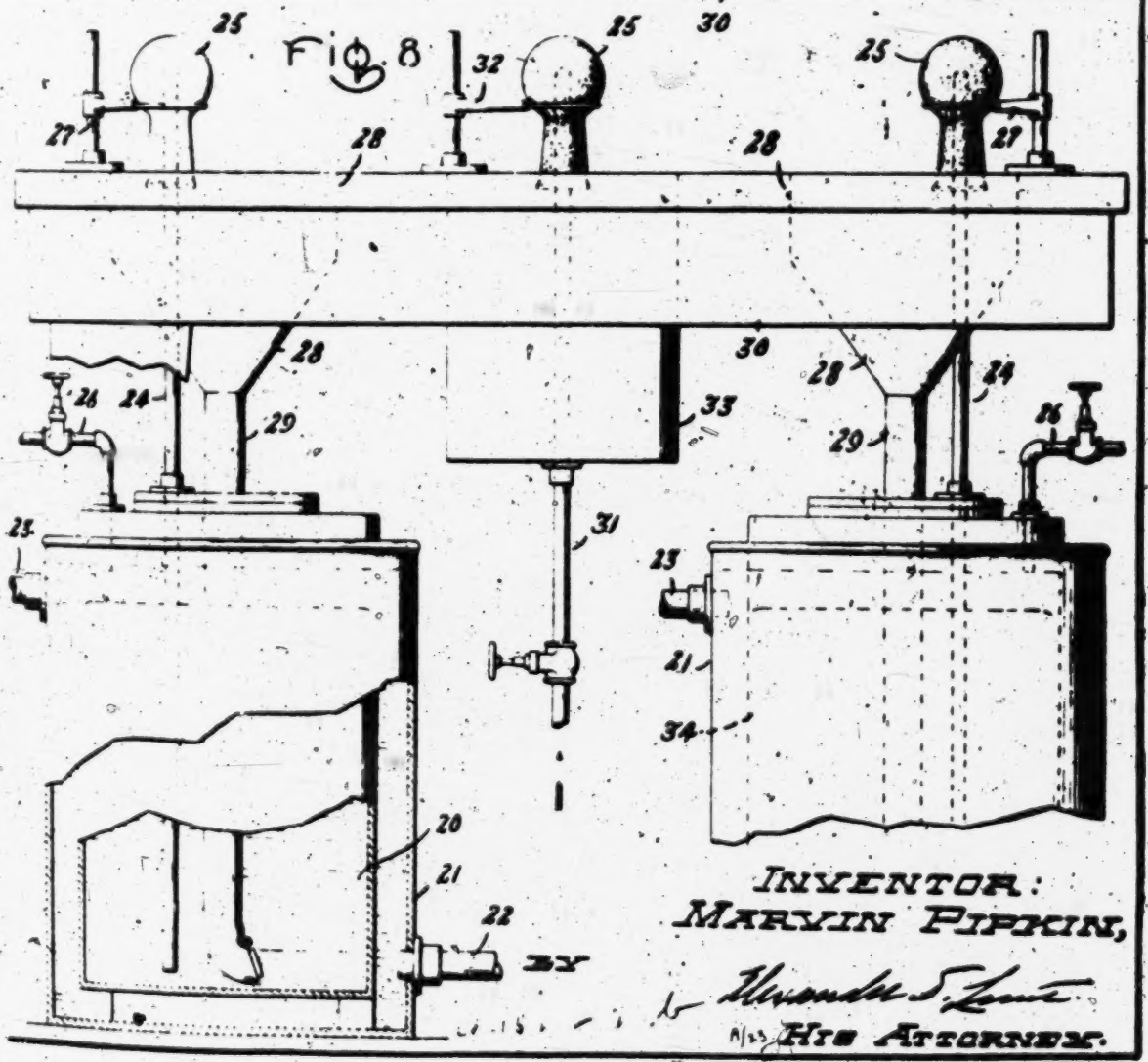


Fig. 8



INVENTOR:
MARVIN PIPKIN,
BY
Alexander S. Lamb
HIS ATTORNEY.

Defendant's Exhibit Dst

Room 240-Annex

Paper No. 2

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON Dec. 2, 1925.

MEH/tr

Please find below a communication from the EXAMINER in charge of this application

Thomas E. Robertson
Commissioner of Patents

Applicant: Marvin Pipkin

Alexander D. Lunt,
C/o General Electric Co.,
Schenectady, New York.

Ser. No. 40,154
Filed June 29, 1925
For Inside Frosted Glass Articles.

MAILED
DEC 2 1925

This application has been examined. Records made of

KENNEDY	733,972	July 21, 1903	176-34x
WOOD	1,240,398	Sep. 18, 1917	do

Claims 1-20 are unduly multiplied by a system which, if extended, would result in a double infinite series of claims. One of these claims may be allowed. The applicant can draw one claim that will afford him adequate protection throughout the entire range of both variables within the limits he can attain.

Claims 21-23 are rejected on Wood. These claims read on Wood when given the broadest interpretation that they will support. In re Levy 331 O.G. 488. It is pointed out that a initial chemical frosting is not definitely claimed nor is any aim not contemplated by the reference.

The same objection is made to claims 24 to 27 as is made to claims 1 to 20. One of these claims may be allowed.

Claim 28 is rejected on Kennedy.

Examiner, Div. 51.

ROOM NOV 23 1926 U.S. PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE

In re Application of
ARVID PIPKIN,
Serial No. 40,152,
Filed June 29, 1925,
Div. 51 - Room 240-Annex.

INSIDE FROSTED GLASS ARTICLES

PATENT OFFICE NOV 26 1926

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In response to Office Action of December 2, 1925, please amend the above-entitled case as follows:

Page 1, line 5, cancel "INSIDE FROSTED GLASS ARTICLES" and substitute THIN DIFFUSING GLASSWARE

Lines 7 and 8, cancel "My invention relates to frosted glass articles and to methods and apparatus for frosting them" and substitute My invention relates to thin diffusing glassware and to methods and apparatus for its production

Line 9, cancel "frosted"

Line 11, after "purposes" cancel the period and insert and still more particularly to such glassware which is light diffusing and has a smooth outer surface.

Line 18, cancel "My invention comprises" and substitute An important feature of my invention is

Page 9, line 20, insert the following paragraph:

As set forth in my application Serial No. 690,672, filed February 4, 1924, and hereinbefore referred to, the probable explanation of the fact that the bulbs made according to my invention have a higher strength than those inside frosted by simple application of the frosting treatment which has hereto-

fore been applied to the outside, is that in the latter case the surface of the glass is covered by a multitude of depressions or pits having sharply defined angles while the depressions or pits where my invention is employed are more or less rounded. However, my invention is not limited to such a structure, as indicated in the appended claims, but comprehends the articles therein defined which have the properties therein set forth. In the claims I have used the term "frosting" to cover the production of the frosted appearance whether by deposition of material or removal ofmaterial. I use the expression "frosting by etching" to cover the production of a frosted appearance by removal of material from the glass surface. As indicated in certain of the claims, the scope of my invention includes diffusing bulbs and similarly thin lassware which is smooth on the outside and which comes within the limitations of the claims as to maximum brightness, absorption and strength.

Claim 21, line, 2, after "inside" insert so as to produce a distinctly whitish appearance

Claim 22, line 2, after "etching" insert until the bulb has a distinctly whitish appearance

Claim 23, line 3, after "etching" insert until the bulb has a distinctly whitish appearance

Claim 28, line 3, cancel "directing a discharge of" and substitute spraying on

Please cancel Claims 1 to 20 inclusive and substitute therefor the following:

1. A diffusing glass bulb for electric lamps and similar devices which when used as the bulb for an ordinary incandescent electric lamp causes the lamp to have a maximum brightness less than ten per cent of that of the same lamp with a clear glass bulb and a light absorption of less than three per cent of the light emitted by the light source, said bulb having a strength to resist breakage by a pact greater than forty per cent of that of the clear bulb.

2. A diffusing glass bulb for electric lamps and

similar devices which when used as the bulb for an ordinary incandescent electric lamp causes the lamp to have a maximum brightness less than five per cent of that of the same lamp with a clear glass bulb and a light absorption of less than four per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

3. A diffusing glass bulb for electric lamps and similar devices which when used as the bulb for an ordinary incandescent electric lamp causes the lamp to have a maximum brightness less than three per cent of that of the same lamp with a clear glass bulb and a light absorption of less than five per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

4. A glass bulb for electric lamps and similar devices which is inside frosted in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than thirty per cent of that of the same lamp with a clear glass bulb and the light absorption is less than three per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than sixteen per cent of that of the clear bulb.

5. A glass bulb for electric lamps and similar devices which is inside frosted in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty per cent of that of the same lamp with a clear glass bulb and the

light absorption is less than three per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than thirty per cent of that of the clear bulb.

6. A glass bulb for electric lamps and similar devices which is inside frosted in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than ten per cent of that of the same lamp with a clear glass bulb and the light absorption is less than four per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than forty per cent of that of the clear bulb.

7. A glass bulb for electric lamps and similar devices which is inside frosted in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than five per cent of that of the same lamp with a clear glass bulb and the light absorption is less than four per cent of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than fifty per cent of that of the clear bulb.

8. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than fifty per cent of that of the same lamp with a clear glass bulb, and which has a strength to resist breakage by impact greater than sixteen per cent of that of the clear bulb.

9. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an

ordinary incandescent lamp comprising such a bulb is less than forty per cent of that of the same lamp with a clear glass bulb, and which has a strength to resist breakage by impact greater than twenty-five per cent of that of the clear bulb.

10. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than thirty per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than thirty-five per cent of that of the clear bulb.

11. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than twenty per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than forty-five per cent of that of the clear bulb.

12. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than ten per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than fifty-five per cent of that of the clear bulb.

13. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than five per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than sixty per cent of that of the clear bulb.

14. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than three per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than seventy per cent of that of the clear bulb.

15. A glass bulb for electric lamps and similar devices which is inside frosted by etching in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than three per cent of that of the same lamp with a clear glass bulb and which has a strength to resist breakage by impact greater than eighty per cent of that of the clear bulb.

Please add the following claims:

16. An incandescent electric lamp having a bulb inside frosted by etching in such manner that glare therefrom is practically prevented as compared with a clear lamp, and having a strength to resist breakage by impact sufficient to permit commercial handling thereof.

17. An incandescent electric lamp having a bulb inside frosted by etching in such manner that glare therefrom is practically prevented as compared with a clear lamp, and the light absorption is less than three per cent of the light emitted by the light source, the mechanical strength of said lamp being such as to permit commercial handling thereof.

Please renumber former Claims 21 to 28 inclusive as 18 to 25 inclusive.

A R G U M E N T

The Examiner's objection to the number of claims has been noted, and in place of the first twenty claims, fifteen

claims have been substituted. As explained in an oral interview, the applicant is quite willing to meet the requirements of the Office as to reduction in the number of claims, but believes that in order to properly protect the invention, it is necessary to have a number of claims of varying scope. In three of the new claims, namely Claims 1, 2, and 3, reference to frosting has been omitted, and the invention is defined in terms of maximum brightness, absorption and strength of bulb. It is believed that the applicant is entitled to this protection since it is believed he was the first to produce a bulb having these properties. Two other claims, namely Claims 16 and 17, differ from the other claims in that dependence is not placed upon figures but reference is made to practical advantages. The applicant is believed to be the first to produce a bulb inside frosted by etching in such a manner as to practically reduce the glare and at the same time to have a bulb which is not so fragile that it cannot be practically handled commercially. As indicated in Claims 4 to 8, the applicant is believed to be the first to produce a bulb frosted in any manner on the inside which is strong, and has comparatively low absorption with an appreciable diffusing effect. Former Claims 21, 22 and 23 have been amended to distinguish over the reference. Wood simply tried to produce an etched surface which apparently was not frosted, and he distinctly states that it did not have a whitish appearance. Former Claim 28, present Claim 26, distinguishes over Kennedy who does not spray the etching material.

Respectfully submitted,

Alexander Lane

Attorney for Applicant.

Schenectady, N. Y.

December 22, 1926.

Defendant's Exhibit D-1

Div. 54 Room 241-A

Address only "The Commissioner of Patents, Washington, D. C." and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

Paper No. 4

All communications regarding this application should give the serial number, date of filing, and name of the applicant

CME/ jmk

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

April 27, 1927

Alexander D. Lunt,
C/o General Elec. Co.,
Schenectady, N.Y.

Applicant: Marvin Pipkin

Ser. No. 40,152
Filed June 29, 1925
For Thin Diffusing Glassware

MAILED
APR 27 1927

Responsive to amendment filed Nov. 23, 1926.

The following additional references are made of record:

Cooley	1,334,017	Mar. 16, 1920	91-44
Day	1,201,219	Oct. 10, 1916	91-44

It is not understood what ordinate units are used in Figs. 1, 2, and the left hand graph in 3.

Claims 1-17 are rejected as failing to claim any invention pointing out as they do, merely the result of the invention. It is just as though a research head called in his assistants and told them to discover an article of such and such specific characteristics. No such article will have been discovered, yet the characteristics are known. Claims 1-17 as worded are no more than statements of the characteristics of an article.

In support of this rejection see O'Reilly v. Morse 15 Howard 62,119; In Re Gardner 1909 C.D. 306; and Heidbrink et al v. Kesson 290 Fed Rep. 665, 320 O.G. 227, and the decisions cited thereunder.

The use of the word "chemically" in claims 18, 19 and 21-24 is objected to since there is no antecedent for it. Otherwise those claims are allowable.

Claim 25 is rejected as unpatentable over either Cooley or Day.

Claim 20 is allowed.

C.M. Lane

Examiner.

CME

MAIL ROOM JAN 1928 U.S. PATENT OFFICE

U.S. PATENT OFFICE JAN 27 1928 DIVISION 54

POWER OF ATTORNEY

IN THE UNITED STATES PATENT OFFICE

In re Application of

Marvin Pipkin

Ser. No. 40,152

Filed June 29, 1925

Div. No. 54 Room No. 241-A

THIN DIFFUSING GLASSWARE

To The Honorable Commissioner of Patents:

General Electric Company, assignee of the entire right, title and interest in and to the above application, hereby revokes all previous powers of attorney and appoints Charles E. Tullar, whose address is c/o General Electric Company, Schenectady, New York, its attorney, with full power of substitution and revocation, to prosecute the said application, to make alterations and amendments therein, to receive the patent and to transact all business in the Patent Office connected therewith.

GENERAL ELECTRIC COMPANY,

By C. W. Allen

Vice President.

Schenectady, N. Y.,

January 10, 1928.

In view of the evidence in the case it is believed that the term of this patent is to be limited to seventeen years as provided by law.

Defendant's Exhibit D-1

U S PATENT OFFICE
PAPER NO 6 B

APR 20 1928

MAIL DIVISION
APR 18 1928
U S PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE

In re Application of)
)
MARVIN PIPKIN,)
)
Serial No. 40,152,) THIN DIFFUSING GLASSWARE
)
Filed June 29, 1925,)
)
Div. 54 - Room 241 - Annex.)

Hon. Commissioner of Patents,

Washington, D. C.

Sir:

In response to Office Action of April 27, 1927, please amend the above-entitled case as follows:

Please cancel Claims 1 to 17 inclusive, and 25.

Claim 18, line 6, after "bulb" cancel chemically

Claim 19, line 6, after "to" cancel chemically

Claim 21, line 9, after "to" cancel chemically

Claim 22, line 9, after "to" cancel chemically

Claim 23, line 9, after "to" cancel chemically

Claim 24, line 9, after "to" cancel chemically

Please add the following claims:

~~26.~~ 1. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strengthto resist breakage by impact is greater than twenty per cent of that of the clear bulb.

~~27.~~ 2. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being character-

ized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than forty-five per cent of that of the clear bulb.

31. A diffusing glass electric lamp bulb having a smooth exterior and which when comprised in an ordinary incandescent electric lamp causes the said lamp to have a maximum brightness less than twenty-five per cent of that of the same lamp with a clear glass bulb, a light absorption less than three per cent of the light emitted by the filament and a strength to resist breakage by impact greater than twenty per cent of that of the clear bulb.

A R G U M E N T

By this amendment a total of eighteen claims have been cancelled and three claims added with the result that the number of claims has been reduced by fifteen. At present there are ten claims and seven of them, which are method claims, were indicated to be substantially allowable in the last Office Action. The Examiner will remember the oral interview in this case at which time claims substantially like these added in this amendment were considered.

The formal objection to the use of the word "chemically" in certain of the claims has been obviated. The question regarding the ordinate units in Figs. 1 and 2 and at the left in 3 may be answered by calling attention to the legend "Strength On Ivory Ball Tester" which appears at the left of Figs. 1 and 3. The ordinates are stated in the specification to be the readings on the scale of the ivory ball tester which is described in the specification. In order to eliminate the factor of the particular ball tester, reference is made in the claims to percentages which are arrived at by comparison with the strength of the clear bulb tested on the same apparatus.

A/35

At the oral interview the Examiner requested information as to maximum brightness of lamps frosted by the old methods. Attention is called to the portion of the specification from page 5, line 1 to line 18 inclusive and which refers to the full line in the diagram constituting Fig. 2. This refers to the old method of subjecting the bulb to a frosting mixture without the fortification treatment. It is stated that the strength was 44.8 at zero, 11 at ten seconds, 4.2 at twenty seconds, 3 at thirty seconds, and so on as indicated in the diagram. As further stated "The bulbs frosted for ten seconds had only a slight haze and were unsuited for practical use. Those frosted for twenty seconds were not uniform. Those of thirty seconds were better, and from them on the bulbs were suitable." The lower limit given in the claims for strength is twenty per cent of that of the clear bulb which would be about nine. It will be apparent that when a practical frost was applied according to the old methods, the strength had fallen considerably below nine.

The first two of the new claims, which are now numbered 29 and 30, are believed to be as agreed upon with the Examiner at the aforesaid interview. Claim 31 is also included and it is requested that reconsideration be given of its patentability. The objection of the Examiner seems to be that that the claim is too broad in view of O'Reilly v. Morse, in re Gardner and Heidbrink v. Kesson referred to in the last Office Action. It is submitted that in those decisions the invention was a machine and the claims under consideration really amounted to claims for means for accomplishing a certain function. In the O'Reilly v. Morse case the inventor attempted to claim the use of electro magnetism for marking or printing at any distance. As contrasted with these cases, claim 31 is an article or product claim. The reference to maximum brightness as an index of diffusion, to absorption and strength are all references to physical properties of the article. It may be noted in this connection that in the glass class, No. 49, sub-class 90, in which are classified patents relating to glass compositions, there are a number of patents covering optical

glassware and heat resistance glassware which contain claims referring, as far as anything new is concerned, to such properties as co-efficient of expansion, index of refraction, etc. These are no more properties of glass than the properties of diffusion, absorption or strength. The facts in the case are that Pipkin was the first to produce a diffusing electric lamp bulb having the properties stated. It will be noted that reference is made to the fact that the exterior of the bulb is smooth because this is the character of the bulb with which we are concerned. No bulb etched on the inside to a practical extent had been strong enough commercially and certainly no one before Pipkin produced an opal bulb or a bulb coated on the inside which came within the limits of diffusion and absorption specified in the claim. It is submitted, therefore, that Pipkin has made a pioneer invention and should be entitled to an article or product claim which will adequately cover the invention.

Respectfully submitted,

Charles E. Tuller

Attorney for Applicant

Schenectady, N. Y.

JHA:MBC. April 17, 1928.

R137

Defendant's Exhibit D-1

Div. 84 Room 2.1-A Elder-E Paper No. 7

Address only "The Commissioner of Patents, Washington, D. C." and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications regarding this application should give the serial number, date of filing, and name of the applicant

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson

April 26, 1926.

C. E. Tullar,
General Elec. Co.,
Schenectady, N.Y.

Applicant: M. Pipkin

Ser. No. 40152
Filed June 28, 1926
For Thin Diffusing Glassware.

Responsive to amendment filed Apr. 18, 1926:

In view of the oral interview, the case is taken up now while the matter is fresh in the mind of the Examiner.

Claims 18-26, 29 and 30 are allowed.

Claim 31 is rejected on the same grounds as were Claims 1-7 in the last action.

The results obtained from the article are stated, but no new article is claimed by recitation of structure. The only structural limitation is a smooth exterior.

The action is made final.

Examiner.

MAY 25 1928
U.S. PATENT OFFICE

U.S. PATENT OFFICE
Patent No. 8 6
MAY 29 1928
DIVISION 54

IN THE UNITED STATES PATENT OFFICE

462

In re Application of
MARVIN PIPKIN,
Serial No. 40,158,
Filed June 29, 1925,
Div. 54 - Room 841 - Annex.

THIN DIFFUSING GLASSWARE

Hon. Commissioner of Patents,
Washington, D. C

Sir:

In response to Office Action of April 26, 1928, please amend the above-entitled case as follows:

Page 1, line 5, cancel "Thin Diffusing Glassware" and substitute Electric Lamp Bulbs

Page 1, cancel lines 7 to 12 inclusive and substitute therefor My invention relates to bulbs for electric lamps and more particularly to frosted bulbs for such lamps. This application is a continuation in part of my application Serial No. 690,672 filed February 4, 1924.

Page 2, cancel from "while" line 1 to "articles." line 3

Line 4, cancel "article" and substitute bulb

Please cancel the insertion by amendment of November 23, 1926, on page 9, line 20 of the specification and substitute therefor the following:

As set forth in my application Serial No. 690,672, filed February 4, 1924, and hereinbefore referred to, the probable explanation of the fact that the bulbs made according to my invention have a higher strength than those inside frosted by simple application of the frosting treatment which has heretofore been applied to the outside, is that in the latter case the surface of the glass is covered by a multitude of depressions or pits having sharply defined angles while the depressions or pits where my invention is employed are more or less rounded.

62

Defendant's Exhibit D-1

Please cancel Claims 18 to 24 inclusive and Claim 31.

ARGUMENT

The rejected claim 31 has been cancelled. The allowed method claims 18 to 24 inclusive have been also cancelled as it is considered that the invention is much better defined by the article claims and it is desired to avoid any possible contention that the article claims are to be limited by the method claims. This leaves the two allowed article claims 29 and 30 in the case. The amendment to the specification is made with a view to making it consistent with the claims remaining in the case.

Respectfully submitted,

Charles F. Mullen

Attorney for Applicant.

Schenectady, N. Y.

May 25, 1928.

JM'EMC.

Defendant's Exhibit D-1

ADDRESS ONLY
THE COMMISSIONER OF PATENTS
WASHINGTON, D. C.

181

Serial No. 40152

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

June 12, 1928

Marvin Pipkin,

Your APPLICATION for a patent for an IMPROVEMENT in Electric Lamp Bulbs,

filed Jun.29/25, has been examined and ALLOWED with 8 claims

The final fee, TWENTY DOLLARS, WITH $1 ADDITIONAL FOR EACH CLAIM ALLOWED IN EXCESS OF 20, must be paid not later than SIX MONTHS from the date of this present notice of allowance. If the final fee be not paid within that period, the patent will be withheld, but the application may be renewed within one year after the date of the original notice with a renewal fee of $20 and $1 additional for each claim in excess of 20.

The office delivers patents upon the day of their date, on which date their term begins to run. The preparation of the patent for final signing and sealing will require about four weeks, and such work will not be begun until after payment of the necessary final fee.

When the final fee is paid, there should also be sent, DISTINCTLY AND PLAINLY WRITTEN, the name of the INVENTOR, TITLE OF THE INVENTION, AND SERIAL NUMBER AS ABOVE GIVEN, DATE OF ALLOWANCE (which is the date of this circular), DATE OF FILING, and, if assigned, the NAMES OF THE ASSIGNEES.

If it is desired to have the patent issue to an ASSIGNEE OR ASSIGNEES, an assignment containing a REQUEST to that effect, together with the FEE for recording the same, must be filed in this office on or before the date of payment of the final fee.

After issue of the patent, uncertified copies of the drawings and specifications may be purchased at the price of TEN CENTS EACH. The money should accompany the order. Postage stamps will not be received.

The final fee will NOT be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

NOTICE.—WHEN THE NUMBER OF CLAIMS ALLOWED IS IN EXCESS OF 20, NO SUM LESS THAN $20 PLUS $1 ADDITIONAL FOR EACH CLAIM IN EXCESS OF TWENTY CAN BE ACCEPTED AS THE FINAL FEE.

Respectfully

Thomas E. Robertson
Commissioner of Patents.

C. E. Tullar,
General Electric Co.,
Schenectady, N.Y.

IN REMITTING THE FINAL FEE GIVE THE SERIAL NUMBER AT THE HEAD OF THIS NOTICE.

UNCERTIFIED COPIES WILL NOT BE FURNISHED.

Defendant's Exhibit D-1

SEP 20 RECD
SEP 14 28
C.C.U.S.PAT.OFFICE

MEMORANDUM
OF
FEE PAID AT UNITED STATES PATENT OFFICE

Schenectady, N. Y., June 25, 1928

Serial No. 40,152

INVENTOR:

Marvin Pipkin

PATENT TO BE ISSUED TO

GENERAL ELECTRIC COMPANY

NAME OF INVENTION, AS ALLOWED:

ELECTRIC LAMP BULBS

DATE OF FILING:

June 29, 1925

DATE OF CIRCULAR OF ALLOWANCE:

June 18, 1928

The Commissioner of Patents will please apply the accompanying fee as indicated above.

C. E. TULLAR, Attorney.

SEND PATENT

C. E. TULLAR

c/o General Electric Company,

Schenectady, N. Y.

LAW DIVISION
NOV - 6 28
U.S. PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE.

B Original Patent

In re Letters Patent of :
Marvin Pipkin, :
No. 1,687,510, : ELECTRIC-LAMP BULBS.
October 16, 1928. :

Hon. Commissioner of Patents,

Sir:-

On October 16, 1928, Letters Patent No. 1,687,510 for Electric-Lamp Bulbs were granted to General Electric Company as assignee of Marvin Pipkin on an application filed June 29, 1925, Serial No. 40,152. A comparison of the specification of the Letters Patent with the application file in the archives of the Patent Office shows that a certain mistake was made by said Office in printing the specification. The following correction is necessary to make the specification correspond with the file of said application:

Page 2, line 98, "11.37%" should be changed to read

- 1137% -.

In accordance with the provisions of Rule 170 of Office Practice, it is respectfully requested that a certificate setting forth the above correction be duly endorsed upon the Letters Patent, and recorded in the records of patents, and a printed copy thereof attached to each printed copy of the specification and drawings.

Recommended T. A. M.

Letters Patent No. 1,687,510 are transmitted herewith.

APPROVED
NOV 19 1928
Thos. E. Robertson
COMMISSIONER OF PATENTS

Respectfully submitted,

Charles E. Tullar
Attorney.

Schenectady, N. Y.,
November 1. 1928.

242a

ABC

ADDRESS ONLY
THE COMMISSIONER OF PATENTS
WASHINGTON D.C.

Letter No. 219494
10

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

November 15, 1928.

In the matter of
Letters Patent No. 1,687,510,
Marvin Pipkin, Assor.,
October 16, 1928,
Charles E. Tullar, attorney.

REPORT OF THE CHIEF OF THE ISSUE AND GAZETTE DIVISION.

Attorney returns Letters Patent requesting that a certificate be issued correcting the following error:

Page 2, line 98, "11.37%" should be --11375--

Examination of the record discloses that the error is chargeable to the Printer.

Respectfully,

John Hamer

Chief of the Issue Div.

To Commissioner of Patents.

A/4H.

DEFENDANT'S EXHIBIT D-2.

Prior Arts Patents.

UNITED STATES PATENTS.

	Page
No. 121,696, Dated December 5, 1871, to William George Webb	245a
152,059, Dated June 16, 1874, to Thomas Archer	247a
733,972, Dated July 21, 1903, to Patrick Kennedy	257a
1,240,398, Dated September 18, 1917, to Robert W. Wood	261a
1,299,936, Dated April 8, 1919, to Ward Harrison	265a

BRITISH PATENT.

166,133, Dated July 6, 1921, to Percy E. Correll	251a

UNITED STATES PATENT OFFICE.

WILLIAM GEORGE WEBB, OF WORDSLEY, GREAT BRITAIN, ASSIGNOR TO WILLIAM LANGDON LIBBEY, OF NEW BEDFORD, MASSACHUSETTS.

IMPROVEMENT IN THE ORNAMENTATION OF GLASS.

Specification forming part of Letters Patent No. 121,696, dated December 5, 1871.

To all whom it may concern:

Be it known that I, WILLIAM GEORGE WEBB, of Wordsley, in the county of Stafford, in the Kingdom of Great Britain, Glass Manufacturer, have made a new and useful invention having reference to Engraving and Ornamenting Glass, of which the following is a specification:

My invention relates to a new and useful improvement in the art of embellishing and engraving upon glass; and consists in the combined processes of printing and etching, as hereinafter described.

I am aware that printing upon glass, in the abstract, is not new; neither is it new to etch or engrave glass by means of an acid; but the two processes as combined and carried out in my improved manner I believe to be novel, and the result attained thereby to be effected in a more simple, perfect, and expeditious manner than any heretofore adopted.

The impressions which are desired to be reproduced are in the first place to be made upon either steel, copper, or any other sufficiently-hard metal or stone, as may be desirable. The impressions are next printed upon paper and next transferred to the article to be engraved or etched, the engraving of the article being effected in manner as hereinafter described.

In preparing the said plates for carrying out my invention I proceed as follows: In case the outlines of the impression or design I desire to reproduce upon the glass (for instance, a glass globe) are to be intaglio, or formed below the surface of the "ground," and the body of the globe or parts surrounding the design, when finished, are to be transparent, I form the outlines of the design upon the impression-plate in cameo or relief by removing the parts of the plate outside and in close proximity to the design so as to form a shallow depressed border entirely around the latter, whereby, when the plate is used for printing or reproducing the design upon the paper tissue or transferring-paper, such depressed part shall produce an inked border completely circumscribing the design, and, when transferred to the surface of the glass, shall reproduce such inked border thereon, such inked border forming a most perfect outline and protection of the design, and thus enables the whole surface of the glass which is not to be acted on by the acid to be readily covered with a coating of varnish, as all that we have to do is to varnish the parts outside of the inked border, such requiring but little care or skill. Were it not for this inked border around the design it would be totally impracticable, if not impossible, even with the greatest care and skill, in delicate designs, to apply the varnish to the parts immediately around the design without covering more or less of the parts or delicate outlines of the design which are to be acted on by the acid, and thus counteract the harmony of the effect designed, the lines being often so fine and close that it would be impossible to apply the varnish between them, the artistic beauty and perfection of the design depending upon having every iota of the article not to be acted on by the acid protected, and leaving every portion to be acted on perfectly free of any impediment to the direct contact of the acid.

In preparing the plate to reproduce other designs on the glass, for instance, wreaths of leaves and flowers, in which the stem and ribs of the leaves and the flowers are to be in intaglio upon the finished glass, the borders of the leaves and petals of the flowers are to be made upon the plate in intaglio or sunken, so that an inked border shall be formed around such when printed and transferred to the glass, the coating of varnish being applied to the other parts, as before mentioned.

In case the design is to appear in cameo and transparent upon the finished glass, and the ground or body portion of the article is to be of a cloudy or semi-opaque appearance, the impression or design upon the plate is to be made in intaglio or in depression, so that when printed upon paper and transferred to the glass such parts shall be protected from the action of the acid, and thus be left clear and transparent and in cameo, the acid in such case being what I term a "dull acid," which, acting upon the unprotected portion, slightly decomposes such and gives a cloudy appearance thereto.

The etching of the glass when printed and the proper parts have been varnished is accomplished in the following manner: A tank of gutta-percha or other suitable substance is provided, containing within it a combination of hydro-fluoric acid and nitric acid in the proportion, by preference, of about one part of nitric acid to about fifty parts of hydro-fluoric acid. The articles of glass to be embellished and etched are to

be affixed to a revolving frame or shaft, which is caused by any convenient means to rotate within the tank in such manner that during each complete revolution of the shaft or frame the articles required to be operated on will have been submerged in the fluid and withdrawn from it, the object of such being to remove the silex or elements of the glass which have been decomposed by the action of the acid, and thus allow the more ready access of the acid to the parts of the glass to be etched; or the said articles may be placed upon a suitable frame and alternately submerging and elevating the same within the acid in the tank; or the articles may be placed over the tank and the acid poured upon them in intermittent streams.

That my invention may be fully understood and the manner of carrying it into effect may be clear I will now particularize the means employed. I will first describe what I call the cold process of printing upon glass. The ink employed for printing may be composed of equal parts of beeswax, resin, and white wax, (say about one pound of each,) one-third part of boiled linseed-oil, (say about five ounces,) together with one-third part (say about five ounces) of peroxide of iron, mixed together with one-half part (say about eight ounces) of turpentine, well boiled together. The varnish for protecting the glass may be composed of equal parts of bitumen, beeswax, resin, and white wax, and ten parts of turpentine, well boiled together.

As to the printing-plates, as before explained, the design may be engraved or etched upon either steel, copper, or stone. The ink is applied with a knife to the depressed portions of the plate with which the printing is done, the raised portions being cleaned; and the plate is next placed under the printing-press. The impression obtained is next transferred to the glass and is rubbed on with a flannel. To readily remove the printing-paper which has been used I take a weak solution of ammonia and water. The parts of the glass not to be acted on by the acid are next to be varnished, and the article is then ready to be engraved or etched, and is to be placed in the mixture of hydro-fluoric and nitric acid and manipulated, as before explained, until the acid has removed the unprotected portions of the glass to the desired depth.

I will next describe what I call the hot process of printing upon glass: The ink in this case should, by preference, consist of a compound composed of one quart of boiled linseed-oil, two ounces of resin, and two ounces of red lead, the whole to be boiled together to a thick consistency. Then I take one part of asphaltum and one part of gas-tar, which I boil to a proper consistency. Afterward I mix an equal part of the oil mixture with a corresponding quantity of this asphaltum, which produces an ink ready for use. The impression-plate, having been made as before explained, is to be warmed, and the ink is laid on with a ~~leather boss~~; and after the projecting parts of the plate are cleared it is put under the printing-press, and the design transferred to the glass by means of a flannel rubber, as before. The paper employed may be removed from the glass by means of clean water; and it should be mentioned that the paper used for printing is "pottery tissue," and is to be damped, before being used, with a solution of soft soap and water. The process of etching is the same as that before explained as applicable to the cold process.

Sometimes, both in the cold and hot process, after being etched it is desirable to give the glass a cloudy appearance. In this case it is to be placed in a dull acid, which may be composed of four parts of water and one part of hydro-fluoric acid, the acid being neutralized by carbonate of soda, which produces fluoride of sodium. To five parts of the fluoride of sodium so formed add one part of acetic acid. The manipulation before described is also applied to the articles placed in the dull acid. Another dull acid may be produced by taking, say, sixteen ounces of hydro-fluoric acid and seven and three-fourths ounces of carbonate of ammonia, which should be mixed gradually.

Having described the nature of my invention and the manner in which the same is or may be carried into effect, what I claim is as follows:

1. For the purpose of engraving and ornamenting glass-ware, the combined processes of printing and etching, substantially as hereinbefore specified.

2. In the process of etching glass, submitting the latter to the intermittent action of the acid, substantially as and for the purpose set forth.

WILLIAM GEORGE WEBB.

Witnesses:

GEORGE ROBINSON HOLLAND,
Patent Agent, Birmingham, England.

ALFRED THOMAS BAKER,
Clerk to the said
George Robinson Holland.

(54)

ARCHER. 152,058

Defendant's Exhibit D-2

T. ARCHER.

Processes of Ornamenting Hollow Articles of Glass.

No. 152,059. Patented June 16, 1874.

"Ornamenting Hollow Articles of Glass."
Filed Oct 10 1873.

"I close the open ends or ends of the Article to be ornamented, the inner surface of which being already provided with the desired design printed or painted in material capable of resisting the action of the fumes of fluoric acid introduced as described in Claim."

UNITED STATES PATENT OFFICE.

THOMAS ARCHER, OF NEW YORK, N. Y.

IMPROVEMENT IN THE PROCESSES OF ORNAMENTING HOLLOW ARTICLES OF GLASS.

Specification forming part of Letters Patent No. **152,059**, dated June 16, 1874; application filed October 10, 1873

To all whom it may concern:

Be it known that I, THOMAS ARCHER, of the city, county, and State of New York, have invented a Process for Ornamenting Hollow Articles of Glass, of which the following is a specification:

This invention relates to a certain process for producing designs or ornaments on the inner or concave surface of a hollow article of glass or other vitreous material by first printing on said surface with suitable ink the designs required, and then closing the article at both ends, and finally admitting to its interior the fumes of fluoric acid, so that the effect produced by such designs or ornaments is improved, the cost of such etching lessened, and the usual acid-chamber dispensed with, and the etching produced with more ease and facility than heretofore; and, further, the designs or ornaments created are protected from injury, and the full strength of the glass preserved.

In carrying out my invention I take a hollow article of glass, such as glass globes, shades for lamps, or for statuary or other articles, vases, and so forth, and print, stamp, or paint on its inner concave surface a design with printers' ink or other suitable material, leaving those portions of the surface of the glass exposed which are to be acted on by the etching-liquid. The vessel is then closed at its end or ends, and the fumes of fluoric acid introduced into the interior of said vessel, so that the etching is effected with comparative ease and facility, and the cost of producing such designs or ornaments is materially lessened, since the usual acid-chamber for inclosing the vessel to be etched is dispensed with; and, further, the fumes of the fluoric acid can also be used for grinding the interior or concave surface of the glass after the ornaments have been finished and protected by printers' ink.

The designs or ornaments, after being cut or produced, are developed and prominently brought out by placing pebbles, bits of metal, or sand into the interior of the article, and revolved therein, so that said material will produce a dull surface on those parts not touched or eaten away by the acid.

By ornamenting the inner concave surface of the glass the outer surface is left entirely intact; and since, in blown articles of glass, such as globes or shades, the outer surface is always the best and strongest portion of the glass, in an article ornamented according to my invention the full strength and beauty of the glass is preserved. Furthermore, the ornaments or designs produced on the inner concave surface of a hollow article of glass are not exposed to dust or other impurities, like those produced on the outer convex surface of such articles, and they are less liable to become injured.

I claim as my invention—

The within-described process of producing designs on the inner surface of a hollow article made of glass or other vitreous material by first printing on said surface with suitable ink the designs required, then covering the opening or openings so as to form a closed chamber, and finally admitting to the interior thereof the fumes of fluoric acid, as set forth.

THOMAS ARCHER.

Witnesses:
J. M. DRISCOLL,
W. HAUFF.

British Patent No. 166,133, Dated July 6, 1921, to Percy E. Correll.

PATENT SPECIFICATION

Convention Date (Australia): July 9, 1920.

166,133

Application Date (in United Kingdom): July 6, 1921. No. 18,317/21.

Complete Accepted: Sept. 7, 1922.

COMPLETE SPECIFICATION.

Improvements in and relating to "Screens" and "Sheets" and the like for the Reception of Optically-projected Pictures, Images and the like.

I, PERCY EDWARD CORRELL, of Verco Buildings, North Terrace, Adelaide, State of South Australia, Commonwealth of Australia, British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to "screens" or "sheets" and the like adapted for the reception of optically-projected images, pictures or the like and is applicable to lantern and cinematographic "screens" or "sheets".

In screens for projection it has been proposed to employ a sheet of glass which is matted on one side by being ground or etched and provided on the other side with the usual silver coating, also it has been proposed to form a screen of a glass plate having the surface roughened by concave or convex lenticular granulations and coated with an extremely thin metallic or other coating.

In a screen formed of thin sheet aluminium or aluminium alloy it has been proposed to polish the surface and form a minutely pitted silvery sheeny surface on same by etching with hydrofluoric or other acid or by sandblasting and then rounding off and polishing the surfaces of the pits caused by the etching or sandblasting by brushing same with a revolving wire brush or other suitable means.

The object of this invention is to provide an improved screen formed of plate glass.

According to this invention I employ a sheet of plate glass and form on same a satiny sheeny surface which consists in a continuous succession area-wise of approximately equal formed rounded off projections, such formation being of minute and regular character, such that the granulation described is almost invisible to the naked eye, in some cases the back of the screen may be silvered and in other cases I may form the glass plate with a series of flutes, prisms, ridges, grooves, corrugations or the like.

The satiny sheeny surface is produced by first heavily matteing with "white acid", sandblasting or equivalent and subsequently reducing or clearing such surface with hydrofluoric acid.

The invention provides for the construction of improved "screens", "sheets" or the like of great efficiency such in some cases as to permit of the entirely satisfactory viewing in full indoor daylight or in the presence of bright artificial lights of cinematographic or other pictures projected thereupon, and such, in same other cases as to permit of the projection in darkness (as at night) of pictures of entirely satisfactory brilliancy but with considerably less expenditure of light-power than necessary for the projection of pictures of equal brilliancy upon the ordinary white "sheet" commonly used, thus reducing both the amount of heat generated in the operating box, where provided and the cost of projection whilst at the same time ensuring other advantages.

In this specification "screen" is used to mean and embrace any device used to receive an optically-projected image or

picture; "lantern" is intended to mean any apparatus used for projecting such images or pictures.

The "satin-surface" to which reference has been made above may be given to the surface of plate glass by first heavily matteing with an acid well known in the glass etching trade as "white acid" and which consists of a mixture of hydrofluoric acid and an alkali such as carbonate of soda and water and subsequently reducing or clearing fully with hydrofluoric acid, thus producing a finely granulated and slightly diffusive surface exhibiting a satin like "sheen" or like effect.

A surface optically equivalent for the purpose and practice of this invention to the "satin-surface" obtainable as above indicated may be obtained by first frosting heavily by sandblasting or grinding in accordance with well known practice and subsequently "reducing" or "clearing" very fully with hydrofluoric acid, so that the original great diffusivity of the frosted surface is very markedly reduced.

In the case just referred to the front surface of the "screen" may be prepared by the only partial reduction or clearing of a previously sandblasted or ground surface, images formed thereon being then visible over a wider angle but of correspondingly less brilliancy than in the case of the more complete reduction or clearing of such a previously sandblasted or ground surface.

In some cases laterally refractive or reflective flutes, prisms, ridges, grooves, corrugations or the like are provided, arranged vertically from top to bottom, either preferably on the back (with a view to the prevention of the lodgment of dust and the like thereon), or on the front of the "screen", or in some cases on each surface thereof, such flutes, prisms, ridges, grooves, corrugations or the like ensuring a considerable expansion of the lateral limits within which the image formed on such "screen" may be viewed efficiently. An embodiment of the invention embracing this feature takes the form of a "screen" adapted for the projection for instance in the home—of small lantern, cinema or other pictures. This is constituted by a sheet of glass having formed on one side thereof parallel flutes, prisms, ridges, grooves, corrugations or the like and prepared either on one or on both sides with the "satin-surface" or its equivalent and silvered on one side.

The first illustrative embodiment of the invention takes the form of a "screen" adapted for the display of lantern, cinema or other pictures or the like. It consists of a sheet of plate glass one of the surfaces of which, hereinafter to be termed the back surface, is prepared in accordance with this invention with the "satin-surface" or its optical equivalent. The back surface of the screen is silvered and backed in accordance with practice usual in the manufacture of glass mirrors.

As a modification of the above, the front surface (which is unsilvered) also is prepared with "satin-surface", the reflection mirror wise of the projecting lantern or the like by such surface being thereby prevented.

Each of the above constitutes a very efficient form of "screen", image-forming rays projected thereupon being reflected within the limits of a comparatively small angle, the image as viewed from within the limits of such angle of reflection of the image-forming rays appearing much brighter under similar projection conditions or arrangement than the image formed on an ordinary white "sheet" or "screen" as commonly used.

Another embodiment of the invention for the display of lantern, cinema or other pictures consists of a sheet of plate glass of which the front surface only is prepared with the "satin-surface" or its equivalent; the back surface being merely silvered without other modification so that this embodiment may be considered as an ordinary plate glass mirror of which the front surface has been modified by the preparation thereof according to this invention with the slightly diffusive "satin-surface" or with its optical equivalent. This screen permits of the projection of pictures of a most remarkable brilliancy readily visible over a limited angle of view—in full indoor daylight, or in the presence of bright artificial lights, the projection of images thereupon being effected preferably by a beam of image producing rays of low angle of divergence.

The invention also applies to translucent "screens" suitable for cinema and lantern-slide or other projection purposes in shop windows or elsewhere and for use in other cases where the pictures or the like projected thereupon are to be viewed in each case from the side of the screen opposite from that side on which the lantern is positioned, the silvering being dispensed with in such cases. Any

of the prepared glasses hereinbefore described but more especially those in which the diffusivity has not been too greatly reduced may be used as translucent "screens" for such viewing of images by light transmitted therethrough; it being kept in mind that a slight granulation has a very much greater diffusive effect when silvered and diffusing reflectively than when unsilvered and diffusing transmissively.

The "screens" or "sheets" herein described may in some cases, if desired, be constructed in more than one piece, for instance in the case of a fluted screen of glass the flutes may be provided on a sheet of glass used in conjunction with a separate piece of glass provided with the specially prepared diffusive surface, and so forth, as will be readily understood.

The specially prepared surfaces described have diffusive effects very dissimilar in the degree or order thereof from the diffusive effects of ordinary frosted surfaces secured by sandblasting or grinding, the surfaces required for the practice of this invention being by no means ordinary unmodified frosted surfaces, such being now and hereby disclaimed as altogether unsuitable for the purposes of the invention.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. In screens for the exhibition of optically-projected pictures and the like and consisting of a sheet or sheets of plate glass, forming a satiny sheeny surface on same by first heavily matteing with white acid, sandblasting or equivalent and subsequently reducing or clearing such surface with hydrofluoric acid so as to leave an area of approximately equal formed rounded-off projections substantially as set forth.

2. In a screen for the exhibition of optically-projected pictures and the like as claimed in Claim 1, silvering one or the other of the surfaces substantially as set forth.

3. In a screen for the exhibition of optically-projected pictures as claimed in Claim 1, forming the plate glass with a series of flutes, prisms, ridges, grooves, corrugations or the like substantially as set forth.

4. The improved construction of screens for exhibition of optically-projected pictures and the like prepared substantially as described.

Dated this 6th day of July, 1921.

H. GARDNER & SON,
Chartered Patent Agents,
173—4—5, Fleet Street, London, E.C. 4,
Agents for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1922.

Defendant's Exhibit D-2

United States Patent No. 733,972, Dated July 21, 1903, to Patrick Kennedy.

Defendant's Exhibit D-2

PATENTED JULY 21, 1903.

No. 733,972.

P. KENNEDY.

METHOD OF FROSTING GLASS BULBS OR GLOBES.

APPLICATION FILED DEC. 26, 1902.

NO MODEL.

Fig. 1.

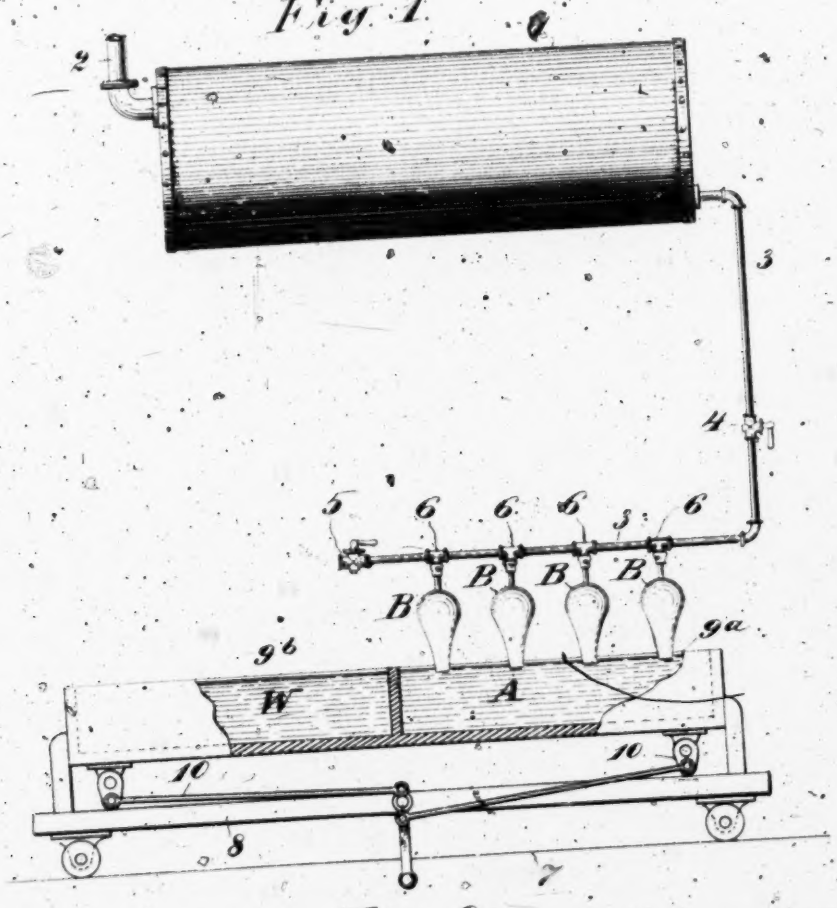
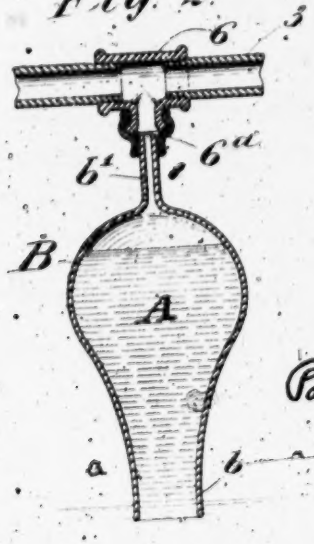


Fig. 2.



WITNESSES:

F. H. Thomas

Peter A. Ross

INVENTOR

Patrick Kennedy

BY

Henry Connett

ATTORNEY

No. 733,972. Patented July 21, 1903.

UNITED STATES PATENT OFFICE.

PATRICK KENNEDY, OF NEW YORK, N. Y., ASSIGNOR TO CONSOLIDATED RAILWAY ELECTRIC LIGHTING AND EQUIPMENT COMPANY.

METHOD OF FROSTING GLASS BULBS OR GLOBES.

SPECIFICATION forming part of Letters Patent No. 733,972, dated July 21, 1903.

Application filed December 26, 1902. Serial No. 136,611. (No model.)

To all whom it may concern:

Be it known that I, PATRICK KENNEDY, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, and city and State of New York, have invented certain new and useful Improvements in Methods of Frosting Glass Bulbs or Globes, of which the following is a specification.

This invention relates to a method of frosting the interior surfaces of glass bulbs or globes—such as those employed in incandescent lamps, for example.

The ordinary hollow glass bulb for an incandescent lamp has a globular or pear-shaped body, and when it comes from the glass-blower the bulb has a stem or neck at one end and a rather slender tube or stem at its crown or opposite end. This latter stem is employed for producing the final vacuum in the globe, after which it is sealed by melting and the surplus of the tube or stem removed or broken off.

The object and purpose of the present invention is to produce on the inner surface of the bulb a frosted appearance, which may cover the whole of the said inner surface or only a part thereof, as will be hereinafter explained. To effect this object, according to the present invention I charge the upright bulb through its lower tubular stem with an etching or corroding acid—as hydrofluoric acid, for example—by pressure on the body of said acid, and after it shall have produced the desired effect by corroding or etching the inner surface of the hollow bulb the acid is allowed to flow out by gravity, the pressure being balanced or removed. In order to cleanse the bulb thoroughly of the acid, the above operation is repeated with water, which rinses out the bulb. This result may be effected by immersing the lower stems or necks of the bulbs in the acid or liquid in a closed receptacle and putting air-pressure on the liquid, so as to cause it to rise in the bulbs to the desired extent, or it may be done by using an open liquid-receptacle and exhausting the air from the bulbs at their upper stems. In this case the pressure on the liquid acid or water will not exceed that of the atmosphere.

In order that my method of frosting may be the better understood, I have shown in the accompanying drawings a means or apparatus which may be employed for carrying it out, and in these drawings—

Figure 1 is a side elevation, on a small scale, of the entire apparatus; and Fig. 2 is a sectional detail view on a much larger scale.

1 designates a drum or vessel, commonly called a "vacuum reservoir or chamber," the air being continuously drawn therefrom through a pipe 2 by any known form of vacuum-producing pump or apparatus. Connected with the drum 1 is a pipe 3, having in it two cut-off cocks 4 and 5, and between these cocks in a horizontal portion of the pipe 3 are couplings 6 for the attachment of the glass bulbs B. Fig. 2 shows a convenient form of coupling. The bulb B has tubular stems at its opposite ends—that is to say, the neck *b* and the tube *b'* at the crown. The bulb is coupled and suspended by inserting the tube *b'* up into a rubber sleeve or collar 6^a, forming part of the coupling 6.

On a suitable bed or table 7, Fig. 1, is mounted a carriage 8, and on this carriage is mounted a receptacle 9, partitioned to form an acid-compartment 9^a and a water-compartment 9^b. This receptacle is seen partly in section in Fig. 1 to show the liquids therein—namely, the acid A and water W.

Some suitable means, as 10, is provided for conveniently raising and lowering the receptacle 9.

The operation is as follows: The receptacle 9 being lowered or depressed, the bulbs B are attached to and suspended from the couplings 6 by their stems *b'*. The carriage 8 is now shifted until the acid-compartment 9^a is under the bulbs. The receptacle is now elevated by the means 10, which causes the necks *b* of the suspended bulbs to dip in the acid. The cock 4 is now gradually opened, and the exhaustion of the air from the bulbs causes the acid to rise in the same uniformly to the desired height or level, after which the cock 4 is closed. When the acid shall have remained in the bulbs long enough to serve its purpose, the cock 5 is opened, so as to admit air to the bulbs, when the acid will at once flow out of them by gravity. The receptacle 9 is now lowered and shifted until the bulbs

are over the compartment containing the water W and then again elevated until the necks of the bulbs dip into the water. The cock 5 is now closed and the cock 4 opened, when the water rises in the bulbs and fills them. Cock 4 is now closed and cock 5 opened to allow the water to run out. This filling with water and emptying may be repeated to an extent sufficient to thoroughly cleanse the bulbs, after which they are removed and dried. This process of washing is desirable, as it avoids the liability of water containing acid coming in contact with the exterior surface of the bulb.

Obviously bulbs may be treated singly by this process, and any known air-exhausting means may be employed.

By "acid" is here meant any liquid capable of producing the frosting or appearance called "frosting" on the surface of the glass. Usually hydrofluoric acid or its compounds are employed for acting on or etching on glass, and this art is now well understood. My invention relates to a new method of effecting the frosting on the inner surfaces of the bulbs, globes, or the like, so as to leave the outer surface of the same smooth or polished as it comes from the glass-blower. Obviously it is not essential that the hollow glass article shall be actually bulbous or globular. It might be partially or wholly cylindrical, for example.

Having thus described my invention, I claim—

1. The herein-described method of frosting the interior surface of a hollow bulb or the like of glass and having openings at top and bottom, which consists in immersing the open lower end of the bulb into a corroding liquid and forcing the liquid to rise in the same by air-pressure, then removing said pressure and permitting the liquid to flow out of the bulb by gravity, then rinsing out the bulb with water to cleanse it of acid, and then drying the bulb.

2. The herein-described method of frosting the interior surface of a bulb or the like of glass and having openings at top and bottom, which consists in first charging the bulb with a corroding liquid, then allowing said liquid to flow out, then forcing water to rise in the bulb by air-pressure, then removing said pressure and permitting the water to run out, and then drying the bulb.

3. The herein-described method of frosting a glass bulb or globe interiorly, which consists in first exhausting the air from the upper end of the bulb while the lower end is immersed in the corroding liquid, whereby the latter is caused to rise to the desired level in the bulb, then after the corroding liquid has effected the desired result, admitting air to the upper end of the bulb for evacuating the bulb by gravity, and then washing out the bulb with water and drying same.

4. The herein-described method of frosting the interior surface of a hollow bulb or the like of glass and having openings at top and bottom, which consists in immersing the open lower end of the hollow article in a frosting liquid, and forcing the liquid to rise in the same by air-pressure, the removing of said air-pressure and permitting the liquid to flow out by gravity, and then removing and drying the article.

In witness whereof I have hereunto signed my name, this 24th day of December, 1902, in the presence of two subscribing witnesses.

PATRICK KENNEDY.

Witnesses:
PETER A. ROSS,
WILLIAM J. FIRTH.

Defendant's Exhibit D-2

United States Patent No. 1,240,398, Dated September 18, 1917, to Robert W. Wood.

62a

Defendant's Exhibit D-2

R. W. WOOD.

METHOD OF MAKING LIGHT DIFFUSING SCREENS.

APPLICATION FILED MAY 29, 1913.

1,240,398.

Patented Sept. 18, 1917

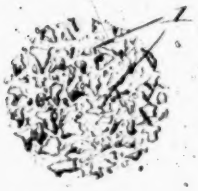


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

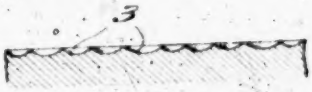


Fig. 6.

Witnesses
E. G. Marshall
M. C. Imirie

Inventor
R. W. Wood.
By John W. Holk
his Attorney

UNITED STATES PATENT OFFICE.

ROBERT W. WOOD, OF BALTIMORE, MARYLAND.

METHOD OF MAKING LIGHT-DIFFUSING SCREENS.

1,240,398. Specification of Letters Patent. Patented Sept. 18, 1917.

Application filed May 29, 1913. Serial No. 770,672.

To all whom it may concern:

Be it known that I, ROBERT W. WOOD, a citizen of the United States, residing at Baltimore city and State of Maryland, have invented certain new and useful Improvements in Methods of Making Light-Diffusing Screens, of which the following is a specification.

An ordinary ground glass screen, while diffusing the transmitted light very perfectly, transmits only from 60% to 70% of the total light which falls upon it, reflecting back a large proportion of the light. This results from the circumstance that the surface of the glass is cut into irregular crevices, pits and grooves of considerable depth, the pits reflecting the light at a large angle of incidence, often in a to-and-fro manner, either returning it toward the source, or scattering it laterally within the glass plate.

This unfavorable action I have overcome by treating the surface of the glass by a process which gives it a structure of considerable regularity, the surface being covered with very minute smooth depressions similar to concave lenses. These lenses are not necessarily regular in outline, but are contiguous; that is, they run together along their edges, the whole forming a cellular structure when viewed under the microscope, totally different in appearance from the surface of glass plates ground or etched by the usual methods. These microscopical lenses, which cover the surface, diffuse the light in a very perfect manner and transmit practically all of the light, the loss due to reflection from the steep sides of irregularly formed pits being absent in this case.

Referring to the accompanying drawing:

Figure 1, represents in top plan the surface of an ordinary ground glass plate, as viewed under a microscope;

Fig. 2, an enlarged cross-section of the same;

Fig. 3, a top plan view of the surface of a glass plate as viewed under a microscope, and pitted by an air blast as in the first step of the process herein described;

Fig. 4, an enlarged cross-section thereof;

Fig. 5, a top plan view as seen under a microscope, of a glass plate after the pits have been treated according to my process to form concave lenses, and

Fig. 6, an enlarged cross-section thereof.

One embodiment of my method of making such screens is as follows: A blast of air charged with a fine dust of flour emery or carborundum is caused to play over the surface of the glass, for a few seconds. The effect is to produce a very slight cloudiness of the surface, which is scarcely noticeable. Each grain of dust has, however, produced a microscopical dent in the surface by chipping out a minute fragment of glass. The surface is now flowed with hydrofluoric acid, which enlarges and smooths out the pits made by the emery dust grains into the minute concave lenses previously alluded to.

When the acid has done its work, the plate is washed to remove the acid. The time the acid has to stay on the plate may be readily determined by experiment, and after one has become accustomed to the process, the appearance of the glass itself will show when the acid has done its work.

In the accompanying drawings, 1 indicates the crevices formed in the surface of ordinary ground glass; 2, the microscopic dents or pits made by the emery dust grains according to the method herein described, and 3, the minute concave lenses formed by enlarging and smoothing the pits 2, as herein described.

The diffusing power of a plate prepared in this way is fully equal to that of the usual ground glass, while the intensity of the transmitted light is very nearly double that transmitted by such ground glass.

When placed before a dark back-ground, and illuminated, my glass appears very nearly as black as ordinary untreated glass, in contrast to the milky white appearance of ordinary ground glass. This makes it of great value as a focusing screen for cameras. The image formed by the lens upon a glass screen prepared in this way, is by actual measurement double the brilliancy of the image seen on ordinary ground glass, and as the cellular surface reflects little or no light, the use of the black focusing cloth can be dispensed with even out of doors in full sunlight. It is of especial value in the case of cameras of the Graflex type, which suffer somewhat from insufficient brilliancy of the image on the focusing screen.

Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing the very marked loss in the efficiency of the lamp, which results from frosting the bulbs in the usual manner.

It should be understood that the emery

blast operation to which I subject the glass does not produce a surface similar to the ordinary ground glass surface; in my case the pits are separated from each other much more than in the case of ground glass, as will be readily seen from a comparison of Figs. 1 and 3.

The average diameters of the concave lenses which form the cellular surface can be varied by modifying the treatment of the surface previous to the action of the acid. By employing a less strong blast of air and allowing it to act for a longer time the microscopic pits are smaller and more numerous, which results in the production of a cellular structure of finer grain, and a wider angle of diffusion. By controlling in this way the size of the lenses and the depth to which they are excavated, it is possible to vary the angle through which the light is diffused, small angles being better suited to certain purposes than large angles, for example, in the case of window glass in which it is desired that most of the light passes through without excessive lateral diffusion, and here I may remark, when this glass is used in windows it has very much more the appearance of ordinary clear window glass than has the usual ground glass; that is to say, it reflects considerably less light and, therefore, does not present the white or frosty appearance to anything like the extent of the usual ground glass.

While my invention is particularly well adapted to the specific uses herein mentioned, it may have a variety of other applications which it is hardly worth while to here enumerate.

It should also be understood that the specific method set forth herein may be modified without departing from the scope of what I claim.

What I claim is:

1. The method of making a light diffusing screen, which consists in forming in a glass surface a multiplicity of minute pits separated by a plane surface relatively wide as compared with the depth of the pits, then enlarging these pits into contiguous concave depressions, whereby each such depression forms a surface of a concave lens.

2. The method of making a light diffusing screen, which consists in forming in a glass surface by mechanical abrasion a multiplicity of irregular pits separated by a plane surface relatively wide as compared with the depth of the pits, and then smoothing out and enlarging these pits into contiguous concave depressions by the application of acid to the pitted surface of said glass, and then removing the acid therefrom, each of said depressions forming the surface of a concave lens.

3. The method of making a light diffusing screen, which consists in applying a blast of abrasive material to a glass surface and thereby forming in said surface a multiplicity of pits separated by a plane surface relatively wide as compared with the depth of the pits, flowing the pitted surface of said glass with hydrofluoric acid and thereby enlarging said pits into contiguous smooth concave depressions, and then removing the acid from said glass.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT W. WOOD.

Witnesses:

ADRIAN GRAPE,

CHAS. A. NICHOLSON.

HARRISON 1,299,936

2664

Defendant's Exhibit D-2

W. HARRISON.
LIGHTING UNIT.
APPLICATION FILED FEB. 20, 1917.

Patented Apr. 8, 1919.

1,299,936.

FIG. 1

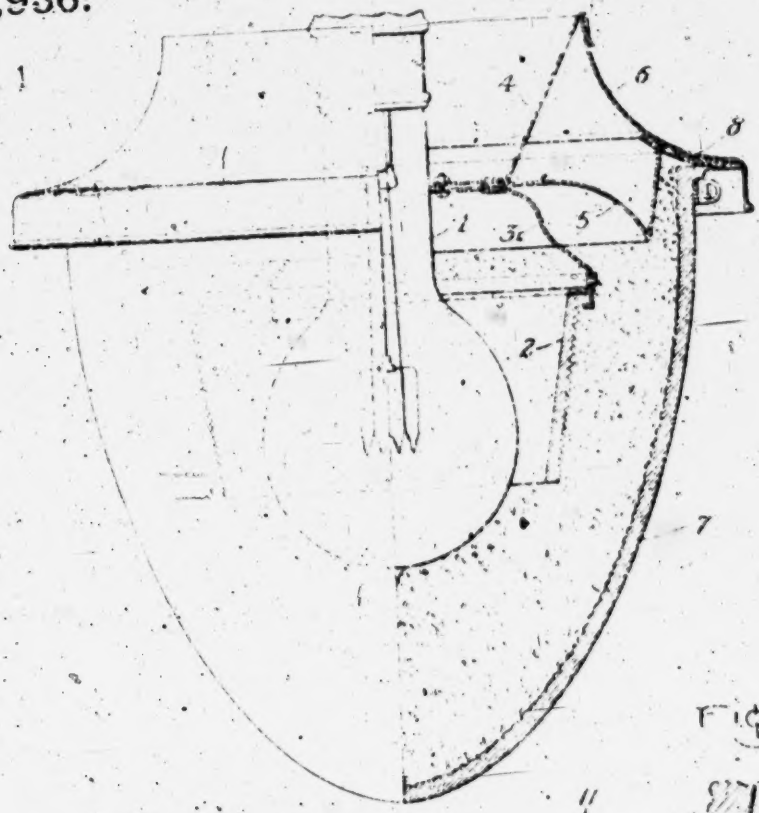


FIG. 3

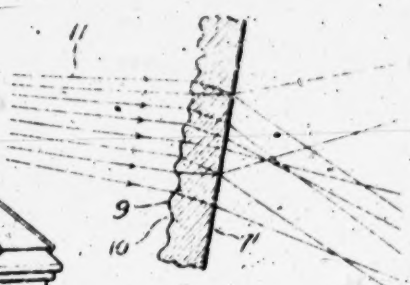
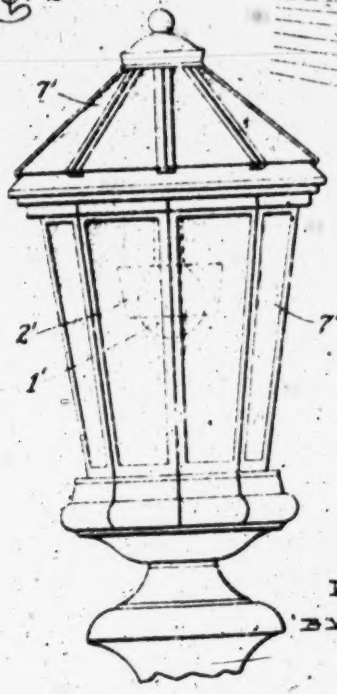


FIG. 2



INVENTOR:
WARD HARRISON,
BY Albert G. Davis
HIS ATTORNEY.

UNITED STATES PATENT OFFICE.

WARD HARRISON, OF EAST CLEVELAND, OHIO, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

LIGHTING UNIT.

1,299,936. Specification of Letters Patent. Patented Apr. 8, 1919.

Application filed February 20, 1917. Serial No. 149,928.

To all whom it may concern:

Be it known that I, WARD HARRISON, a citizen of the United States, residing at East Cleveland, in the county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Lighting Units, of which the following is a specification.

My invention has reference to improvements in lighting units, designed to overcome the defects of fixtures, heretofore used.

When an intense source of light is used in a lighting fixture, the transmission of light is usually modified by shades, refractors, globes, etc., with the view of directing the light to regions where the illumination is mostly needed, and diverting it from regions where the illumination is either not required or is objectionable. Thus, for instance, in street lighting the aim is to direct the main part of the light to the hemisphere below the horizontal plane passed through the source, and it is desirable in this case to avoid the glare which the direct rays from the source would produce. For all these purposes it has been suggested that refractors of definite geometrical design be placed in the path of the rays from the source by which indeed the light was directed, mainly below the horizontal plane. In addition to this, or independently thereof, a diffusing globe, either opalized or sand-blasted or etched was used, whereby the source of light as such became practically invisible. The fixture acted upon the eye as if the diffusing medium itself were the source of light, that is to say, a much larger source of light, which therefore had only a comparatively low intrinsic luminosity. All this was desirable, but a great loss of light resulted from the use of such globes. The diffusing globe alone, without the refracting medium was mainly used in connection with a light source, which, without the aid of refractors directed the light rays into the desired region below the horizontal plane. Of these sources of light the magnetic lamp is a good example.

The opalized globes absorb a great portion of the light emitted by the source. The sand-blasted or etched globes absorb less of the light emitted by the source, but have the objections that the light transmitted therethrough is more or less streaked. Moreover in practice such globes have proven impossible to keep presentably clean.

By my invention these difficulties are overcome by the use of a globe in combination with a refractor. The globe is formed by molding into its surface rather small protuberances and depressions, whereby each protuberance is more or less rounded and merges into the depressions in a smooth and gradual manner. The light passing through such a globe is not resolved into its elements, since all sharp edges formed by the intersection of small plane surfaces are absent. Globes of this character absorb less of the light received by the same than either the opalized or the sand-blasted or etched glass globes. But if the light is transmitted in a direction, at or below the horizontal, these globes do not appreciably modify the direction of the rays. When such globe is used in conjunction with a definite refractor the refracting rays reaching the globe retain the general direction given to the same by the refractor.

For a better understanding of my improved lighting unit reference may be had to the illustrations accompanying this specification. Figure 1 of which shows one type of unit embodying my invention; Fig. 2 shows another type of unit; Fig. 3 is an enlarged sectional view of a portion of the protective globe illustrating the directions of a number of light rays passing therethrough.

Referring to Fig. 1, the lower part of a fixture is shown which is particularly adapted to the housing of a high efficiency incandescent lamp 1. Closely surrounding the lamp bulb is a band refractor 2, the latter being supported in any convenient manner, as for instance by strips 3, which engage an annular shoulder on the top of the refractor and are equally spaced apart by a suitable spacing ring as shown. The upper ends of strips 3 are conveniently bolted to downwardly depending supporting strips 4, and between the adjacent ends of these strips is secured a reflector 5 which is adapted to intercept the upward rays and direct them downwardly in useful directions. The reflector 5 and strips 3 and 4 are adapted to be suspended as a unit from the top of a flar-

ing outer shell 6, it being understood that the shell 6 is adapted to fit into and be secured to a standard fixture of the type shown in Fig. 4. Surrounding the lamp 1 and band refractor 2 is a larger outer protective and light scattering globe 7 which is adapted to be secured to the interior of the shell 6. A suitable dust proof packing, as for instance felt 8, is located between the upper rim of the globe 7 and the shell. In Fig. 2 is illustrated a fixture especially designed for street lamps which embodies also an incandescent lamp 1' and a band refractor 2', illustrated in dotted lines, which are inclosed within an outer globe 7'. In this case the globe 7' consists of a number of glass panes suitably assembled together to form a closure of octagonal contour. In both cases the globe embodies on its interior surface refracting media for producing irregular refraction or bending of the rays in every imaginable direction. These refracting media consist, as shown in Fig. 3 on an exaggerated scale, of a multiplicity of minute merging hills 9 and valleys 10. The rays of light 11 in passing through the globes are bent in various directions in some such manner as is indicated in the vertical plane illustrated in Fig. 3, from which it will be apparent that the general direction of the rays before encountering the globe is substantially preserved. It is understood that these hills and valleys are of such small dimensions and so numerous that practically every light ray entering the glass encounters the glass at an inclination different from every other ray and at an inclination so small as to avoid internal reflections and consequent internal losses which are especially noticeable in prismatic and other diffusing glassware. Substantially every ray is transmitted through the globe, as indicated in Fig. 3, and the efficiency, therefore, of transmission is practically the same as if both surfaces of the glass were plain, whereas the irregular refraction indicated results in the blurring of the most intense light source in such a manner that its outlines are obliterated and the unit is rendered pleasing and harmless to the eyes of the observer. The irregular refractor or globe, therefore, does not substantially affect the directional value of the unit when all of the light is considered and the full effect of the directive value of the band refractor 2 for directing the light below the horizontal is given to the unit, resulting in a distribution particularly adapted to street and certain industrial lighting. As said above, these irregularly formed hills 9 and valleys 10 are pressed into the glass during the process of molding as distinguished from sand-blasting and etching or other types of diffusing glassware. The formation of these refracting media by pressing results in the elimination of sharp points and crevices, which in the sand-blasted and etched and prismatic glassware, in addition to causing streaking cause considerable inconvenience, due to the difficulty of dislocating dirt and foreign matter collected therein. Furthermore, losses by internal reflections are avoided and the characteristic lifeless appearance of diffusing glass is eliminated. It is understood that one of the coöperating mold forms used in making the glassware has irregular hills and valleys formed thereon which correspond to the refracting media 9 and 10 illustrated in Fig. 3. In the case of the panes 7' illustrated in Figs. 2 and 3 these refracting media are incorporated in the rolling or pressing process, and in the case of the globe illustrated in Fig. 1, this is accomplished in the pressing operation by incorporating on the plunger of the mold an irregular surface which corresponds to the irregularly refracting surface formed on the interior of the globe. The moldmaker goes over the entire surface of the plunger with some convenient tool, as for instance, a chisel or milling tool, and forms thereon numerous little depressions, or cavities, as close together as it is practicable to make them, these little depressions corresponding to the hills or bulbular projections 9 formed on the interior of the glass globe. These depressions or indentations on the plunger literally cover the entire surface and are made of small dimensions for a double purpose. In the first place, the sticking of the plunger during the process of molding the globe is entirely avoided, by making the depth of the depressions as small as possible, and, second, the resultant minature refracting media on the interior of the globe, while producing irregular refraction, do not give rise to internal reflections and there are no resultant sharp points or crevices to interfere with the cleaning of the globe.

It has been found that the appearance of the globe may be somewhat improved by incorporating a very slight amount of white coloring material in the glass batch from which it is made so as to make the globe slightly opal.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A lighting fixture for housing a highly intense artificial light source comprising a band refractor closely surrounding the source for modifying the distribution of the light rays and a larger outer protective inclosing glass globe surrounding said source and refractor and having incorporated therein media for producing diffusion of the light rays without impairing the directional value of the unit.

2. A lighting fixture comprising an artifi-

cial light source, a prismatic refractor surrounding said light source shaped to direct the light rays from said source in a desired general direction, and a diffusing element in the path of the directed light rays provided with protuberances and depressions which gradually merge into each other whereby the light rays received by said element are caused to pass through the same without substantial deviation from the general direction given to them by the directing means.

In witness whereof, I have hereunto set my hand this 17th day of February, 1917.

WARD HARRISON.

Correction in Letters Patent No. 1,299,936.

It is hereby certified that in Letters Patent No. 1,299,936, granted April 8, 1919, upon the application of Ward Harrison, of East Cleveland, Ohio, for an improvement in "Lighting Units," an error appears in the printed specification requiring correction as follows: Page 1, line 46, for the word "magnetic" read *magnetite;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of May, A. D., 1919.

[SEAL.]

R. F. WHITEHEAD,

Acting Commissioner of Patents.

Cl. 240—92.

DEFENDANT'S EXHIBIT D-3.

Prior Art Literature.

	Page
Extract from "Die Glashütte", Vol. XVII, Article Entitled "Contributions to the Knowledge of Glass Etching", by Fried. Reinitzer	273a
Extract from "Sprechsaal", Vol. 40, 1907, No. 49, Article Entitled "The Etching of Hollow Glass"	286a
Extract from "The Journal of Industrial and Engineering Chemistry", October 1917, Article Entitled "On the Relation Between the Physical Properties and Chemical Composition of Glass VII-Etch Figures", by Edwin Ward Tillotson, Jr.	291a
Extract from "Sprechsaal", 1906, No. 21, p. 904	296a
Extract from "Sprechsaal", 1906, No. 22, p. 950	297a
Extract from "Hohlbaum", 1910, "Present Day Manufacture, Working Up and Ornamentation of Finer Hollow Glass"	298a
Extract from "Sprechsaal", No. 48, Vol. 45, "How Are Completed Electric Lamps (Glass Bulbs) Best Frosted/Matted?"	303a

"DIE GLASHUTTE."
VOL. XVII.
No. 3, pages 33 to 36; No. 4, pages 49 to 51;
No. 5, pages 61 to 63; No. 6, pages 74 to 76.

CONTRIBUTIONS TO THE KNOWLEDGE OF GLASS ETCHING.*

by

FRIED. BERNITZER.

The peculiarity of the fluorine compounds to attack glass to "etch" it, was already known at a time when fluorine compounds had not been thought of. In 1670 already, Schwankhard in Nuremberg knew that glass is etched by the vapours which escape from a heated mixture of fluor spar and sulphuric acid. The fact that also aqueous hydrofluoric acid attacks glass producing thereby however a smooth surface and not a {frosted / matt} surface, as does the gaseous acid, could not remain concealed for long, when about a century later Scheele, Priestley, Gay-Lussac and Thenard and Davy carried out their researches on fluorine compounds. The practical application of the aqueous hydrofluoric acid was, however, apparently only made in the thirties of this century, namely by English glass manufacturers. (Siegwart, Photogr. Archiv. 1870, page 304.) A German architect is said to have first conceived in 1840 the idea of having windows {frosted / matt-etched} with fluoric acid. It is alleged that this was effected by dipping the glass plates into fluoric acid (?) or by spreading the plates with a paste of fluor spar and sulphuric acid. (Dingl. pol. Journ., vol. 78, page 347). In the year 1855, Kessler introduced the etching of glass plates by means of aqueous fluoric acid into three large glass factories in France, simultaneously with a process for manifolding the etched designs. (Kessler, Dingl. pol. Journ., vol. 170, page 217; vol. 185, page 222. Compt. rend., vol. 61, page 177). The fact that also solutions of alkali fluorides {frost glass / etch glass matt} seems to have become first known by the comprehensive researches on the metal fluorides, which Berzelius carried out in 1824. He states in his text-book that the neutral ammonium fluoride in particular is very suitable for the {frosting / matt-etching} of the glass (see for example 3rd edition of Woehler's translation, vol. 4, page 101). The first practical application of this process was probably made by Boettger and Bromeis, who in 1844, independently of one another, made an invention, according to which glass could be etched by means of an entirely innocuous liquid. (Dingl. polytech. Journ., vol. 92, page 237, and vol. 93, page 298). Since, however, the inventors, who later on combined, carefully kept their process secret, it cannot be said with certainty whether this process was based on the application of alkali fluorides, although this is very probable. The first, of whose process this can be said with certainty and who has also the merit of introducing this method into practice, is Kessler, who in 1858 took out a patent in France relating to the application of alkali fluorides in combination with acids. He obtained the best results with ammonium fluoride. (Kessler, loc. cit.) In 1864 Tessié du Mothay and C. R. Maréchal (Compt. rend. vol. 62, page 301; Dingl. pol. Journ. vol. 161, page 213) published a similar process, which, however, according to the author's own admission was only an imitation of the Kessler process (vide Les Mondes, 1867, page 337 and Zeitschr. d. Vereines deutscher Ingenieure 1867, page 70). Processes based on the same principle were later published by Siegwart and

* It had been our intention to print this interesting paper immediately after its appearance; we attached, however, importance to submitting to our readers also the original illustrations, for the delivery of which we had to wait a long time, this causing the delay of the reproduction of the above paper.

"DIE GLASHUTTE"—(*cont.*).

No. 3, p. 34.

J. B. Miller. The various etching inks too, described by Kessler,* Sabatier,† Slocum,‡ Mueller,‡ and Miller,§ which serve for matt-writing on glass, are based on the application of alkali fluorides, which according to the directions of Sabatier, Slocum and Mueller are mixed with precipitated barium sulphate. In practice the process of smooth-etching with aqueous hydrofluoric acid and that of {frosting / matt-etching} with alkali fluorides have been adopted for obvious reasons. The process of {frosting / matt-etching} with fluor spar and sulphuric acid appears to be quite rightly far less used. Lately a few further methods of {frosting / matt-etching} have been published, which, however, have probably hitherto not found extended application.

While thus the practical part of glass etching has developed to considerable perfection, the theory thereof, which alone evidently can constitute the basis of sound progress, has been very neglected, and the question why certain kinds of processes give a {frosted / matt} and others a clear etching has hitherto only been answered by unproved assumptions or assertions. The first who attempted an explanation of this appears to have been Berzelius. He states in his text-book (3rd edition of Wöhler's translation, vol. 2, page 201) in respect of {frosting / matt-etching} by concentrated acid or acid in the form of vapour: "The cause is that potassium fluosilicate is deposited, which is formed by the action of the acid on the components of the glass, on the other hand, however is washed away if the acid is dilute, by the water in the same without being able to attach itself." Later Tessié du Mothay and Maréchal (Compt. rend. vol. 62, page 301) gave an explanation approximating far less to the truth. According to their opinion, insoluble lead and calcium fluoride as well as a compound of the acid present are formed in the {frosting / matt-etching} by means of alkali fluorides in the presence of an acid and a hygroscopic salt, thereby producing the {frost / matt}. An almost entirely correct explanation of the process of {frosting / matt-etching} by means of alkali fluorides was given by Kessler (Compt. rend. vol. 64, page 177). He states that in his and in Tessié du Mothay's process owing to the addition of the alkali salts difficultly soluble alkali silicofluoride is formed, which as small, granular crystals, settle firmly on the glass; these crystals acted like a dotted etching ground and the added salts as well as the acid served only to render the deposit crystalline and adherent. On etching with ammonium fluoride the crystals can be recognised even with the naked eye or with the magnifying glass. Though this explanation is on the whole correct, there is above all no proof that the crystals are actually alkali silicofluorides and, as will be seen later, many other details are also missing. There is further no explanation why in employing fluor spar and sulphuric acid a {frosting / matt-etching} is produced. With regard to this point I can only find one single, not even quite definite opinion, according to which in these circumstances a {frost / matt} is produced, because the hydrofluoric acid liberated is very concentrated. (Kunst- and Gewerbeblatt fuer Bayern 1856, page 184, and Dingl. pol. Journ., vol. 141, page 237). The view that very concentrated or anhydrous liquid fluoric acid {frosts / etches matt} is altogether very frequently put forward and is inter alia also held by Berzelius. The latter says for example, (loc. cit. vol. II, page 201): "If liquid and diluted acid is employed, then the design appears polished, on the other hand with concentrated or gaseous acid the design becomes {frosted / matt} and more readily visible." I have to remark that this view is wrong. Neither with fuming fluoric acid nor with a mixture of fluoric acid and concentrated sulphuric acid was I able to obtain {frosting / matt-etching}. The etching is in every case smooth.

It is evident from the foregoing that we have still not at all an accurate understanding of what takes place in glass etching, and it will therefore not be superfluous to investigate this matter more precisely. It is at once clear that we are here only concerned with an explanation of the {frosting / matt-etching}, since the phenomenon that aqueous hydrofluoric acid produces a clear etching on glass can easily be explained without any further investigation.

Glass is a completely uniform mixture of various amorphous, i.e. structureless compounds, which in all probability do not exert an entirely equal resistance to the dissolving action of aqueous hydrofluoric acid, which are, however, so little different in this respect from one another that the unevennesses formed by etching a smooth glass surface with aqueous hydrofluoric acid cannot produce the impression of a {frosted / matt} glass surface, but can only produce about the same impression which the ordinary unground plate glass produces on the

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* Kessler: Compt. rend. vol. 64, page 177; Dingl. pol. Journ., vol. 185, page 222.

† Industriebl. v. Jacobsen 1881, page 166; Jacobs. Repertor 1881, I., page 76.

‡ "Sprechsaal" 1883, page 429; Jacobs. Repert. 1883, II., page 80; Industriebl. v. Jacobs., 1883, page 317; Dingl. pol. Journ., vol. 250, page 555.

§ Miller: Die Glasaetzerei, etc., Hartleben chem.

"DIE GLASHUTTE"—(*cont.*).

No. 3, p. 35.

compounds formed completely dissolve in the hydrofluoric acid, any other cause of the formation of unevennesses on the etched glass surface is excluded and the phenomenon of clear-etching by aqueous hydrofluoric acid is explained in an entirely satisfactory manner.

Regarding {frosting / matt-etching} the matter is not so simple. Here the difficulty of the explanation is already considerably increased by the fact that the production of a {frosted / matt} surface can be accomplished by a number of procedures entirely different from one another. Both gaseous hydrofluoric acid and a mixture of fluor spar and sulphuric acid as well as solutions of acid alkali fluorides can produce {frosting / matt-etching} under appropriate conditions, so that according to this it must appear probable that the process taking place in the formation of the {frosted / matt} surface is not the same in all these cases.

It is a priori clear that the {frosted / matt} appearance of the glass can only arise because the surface possesses many unevennesses lying closely adjacent to one another and which are of such a nature that depressions and elevations pass into one another as abruptly as possible. Numerous refracting, diffracting and reflecting phenomena are caused thereby, and owing to this just that glittering tone peculiar to {frosted / matt} glass is produced. It is now very obvious to assume that the shape of these unevennesses may be intimately connected with their mode of formation and that consequently a thorough microscopic investigation of the same might throw some light upon the process of {frosting / matt-etching}. Starting from this assumption I followed the procedure indicated, and have actually obtained results which lead to a fairly satisfactory explanation of the relevant phenomena.

I will first discuss in detail the process of {frosting / matt-etching} by means of alkali fluorides. All directions relating thereto aim at obtaining a solution of an acid alkali fluoride $FlHM$, which in addition contains more or less free fluoric acid and may also contain any soluble inert salt as well. Kessler (loc. cit.) recommends in particular solutions of alkali fluorides, which have been acidified with acetic acid, and prefers ammonium fluoride. The etching bath of Tessié du Mothay (loc. cit.) is obtained by mixing 1000 gms. of water, 250 gms. of acid potassium fluoride, 250 gms. of commercial hydrochloric acid and 140 gms. of potassium sulphate. Siegwart recommends 8 parts of alkali fluoride, 100 parts of water and 1 part of sulphuric acid (Dingl. pol. Journ. vol. 190, page 222) or later, 40 gms. of sodium fluoride, 1 liter of water and 50 gms. of glacial acetic acid (Industriebl. v. Jacobs., 1879, page 60; Jacobs. Repertor., 1879, I, page 120). Finally, J. B. Miller has likewise given two prescriptions, which (recalculated) read: I. 1000 parts of water, 250 parts of sodium or potassium fluoride, 200 parts of potassium sulphate and 166-175 parts of hydrochloric acid; II. 1000 parts of water, 1000 parts of ammonium fluoride, 100 parts of ammonium sulphate and 200 parts of sulphuric acid. These two baths may be used separately or mixed. (Miller loc. cit. and Erfindungen und Erfahrungen by Koller 1879; Industriebl. v. Jacobs., 1879, page 185; Jacobs. Repertor, 1879, page 121). As far as I am aware, a solution of sodium fluoride acidified with acetic acid appears to be quite generally employed in practice, the solution of sodium fluoride usually having been first prepared from sodium carbonate and fluoric acid. One such prescription taken from practice is for example, as follows: 25 parts of crystallized sodium carbonate are dissolved in 5 parts of fuming fluoric acid and 1 liter of the clarified liquid is mixed with 1 liter of glacial acetic acid. In practice the need frequently arises to obtain the {frost / matt} in several tones, in order to produce in this manner various effects. Owing to the particular kindness of Mr. Ed. Kratzmann, Manager of the Royal Hungarian State Glass Painting and Etching Factory in Pest, I have been able to become acquainted with the process applied in connection therewith, and I beg here again to express my thanks therefor. In order to obtain a tone as dark as possible in transmitted light, the same place is {frosted / matt-etched} twice in succession. With one etching a somewhat brighter tone is produced, and for obtaining still brighter tones the surface {frosted / etched-matt} once is {clear-etched / rendered matt} with dilute aqueous fluoric acid once or several times (up to 9 times), the tones becoming thereby brighter and brighter. With the aid of this method whole landscapes which have an uncommonly fine appearance are produced in the above mentioned institute. Owing to the kindness of Mr. Ed. Kratzmann I have acquired a whole range of 11 tones such as are employed in the Pest Institute. If such glass plate {frosted / rendered matt} by {frosting / matt-etching} once is viewed through the microscope with moderate magnification, a very uniform succession of elevations and depressions, which are very soon seen to possess crystal shape, is observed. At the edge of the {frosted / matted} surface these crystals become more and more scanty and are consequently more clearly developed so that the shape can be very easily recognised. Fig. 1 in the appended table shows the edge of such an etching magnified 450 times. The picture

was taken with the aid of a stereoscopic microscope attachment, by means of which the crystal etchings are brought out in great relief and provide an uncommonly fine appearance. It shows one of the above mentioned specimens of the Pest Institute. It is easily recognised that the predominant crystals are hexagonal and agree completely with those of sodium silicofluoride (vide Haushofer, Mikroskopische Reactionen, fig. 79, page 98). Moreover elongated, stretched crystal forms are seen which have the most resemblance to crystals of calcium silicofluoride (vide Haushofer, loc. cit. fig. 23, page 39). Even the appearances which occur on raising and sinking the microscope tube would easily convince anyone that the etched in crystal figures are in relief. This can be proved in a still surer and more certain manner by rubbing the (frosted / matt) plate with a coloured substance, best of all Indian ink, and then rubbing off superficially with alder pith or cork. Under the microscope the whole of the parts lying between the crystal figures then appear coloured, the crystal figures however, colourless. It follows from all this that by the action of alkali fluoride and of free fluoric acid on the glass sodium silicofluoride and calcium silicofluoride are formed, which separate in a crystalline form and act as etching ground, whereas the interstices are deeply etched by the free fluoric acid. The silicic acid and the calcium are in this case taken from the glass, the sodium for the greater part from the etching bath, as well as a smaller part from the glass. It is obvious that when (frosting / matt-etching) a potash glass, the tesseral (hexahedral or octahedral) crystals of potassium silicofluoride also appear, and it would even be possible, as will be easily understood to base a method for the recognition of potash glasses on this behaviour. There remains, however, still one question open as regards the formation of the crystal etchings. According to the above explanation only the bases of the crystals with which these rested on the glass surface should appear as flat figures, between which more or less deep grooves should exist and the question, therefore, arises how it happens that these crystal etchings are complete solid looking imitations of the original crystals. It is very difficult to answer this question. So far I have been able to find only a single partly acceptable explanation, of which however I cannot assert that it is correct. I imagine that smaller crystals are first formed at a considerable distance and these increase in circumference in proportion as the grooves between them deepen while at the same time they grow downwards, so that finally they form hollow bodies, in the interior of which the crystal etching, a true pseudomorphosis, appears as nucleus. These would be similar structures to the well known ladder-like crystals of common salt, the cavities of which here contain the crystal etchings; save that it would be necessary to imagine that the striations formed by the aggregation are much finer both on the crystal etching itself and on the cap covering the same and consisting of the real crystal, than in the case of common salt. These striations might also be effaced by the crystals themselves exerting a weak etching effect on their support since these are indeed soaked through with the acid mother liquor. This last assumption is further supported by the fact that the crystal etchings frequently show important irregularities. Further, some of the faces are sometimes sunk. Thus, the upper face of the middle large hexagonal crystal in fig. 1 is somewhat sunk, which might be attributed to an etching of this kind which was probably followed by an after-growth of the plate existing above this face. This assumption of the formation of the crystal etchings is further particularly supported by the fact that in certain circumstances, namely if the etching was formed very rapidly and from a not too weak acid bath, the etchings show distinctly ladderlike striations as is shown on fig. 6. *a*, *b*.

(Continuation follows.)

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"DIE GLASHUTTE"—(*cont.*).

No. 4, p. 50.

bath. From very concentrated baths therefore, very fine etchings are always obtained. Further it is not immaterial whether the etching bath is composed of potassium sodium or ammonium compounds. The silicofluoride of potassium is the most difficultly soluble that of sodium rather more readily and that of ammonium most easily soluble; therefore the finest etchings are produced in the presence of potassium salts. Further it is now obvious from the behaviour above mentioned that when employing ammonium salts the solutions must be very concentrated, best of all saturated, for sodium salts less concentrated and still more dilute for potassium salts. Since the action of the bath must be the more rapid the more concentrated it is, it follows further that the etching must proceed most slowly when employing potassium salts and most rapidly when employing ammonium salts. Actually ammonium fluoride is employed in all quick etching processes, and it is easy to prove that a concentrated solution thereof acidified with fluoric acid produces a beautiful {frost / matt} in a few seconds. The addition of indifferent salts as well as the magnitude of the acid content likewise influence, of course, the solubility of the silicofluorides, and consequently also the amount of crystallisation and the speed of its formation. In general it can be said that an addition of indifferent salts reduces the solubility, addition of free acid increases it, whereby indeed the possibility is not excluded that certain salts have a dissolving effect. It is probably hardly necessary to mention that when employing potassium or ammonium compounds the resulting crystal etchings have a different shape than when sodium salts are employed. It is true that when a soda glass is used the hexagonal crystals of sodium silicofluoride still occur and that also crystals of calcium silicofluoride are found, but the tesseral crystals of the potassium silicofluoride are also found in considerable quantities. The etchings have in this case the shape of hexahedra or octahedra or combinations of both, or only the triangular faces of the octahedra are developed in relief etching. When employing ammonium salts, crystals are found of the form shown in fig. 6 (*b'*, *c*, *d*), which are evidently isomorphous with those of potassium silicofluoride and belong to ammonium silicofluoride. In fig. 6 two crystals of sodium silicofluoride are seen at *b*, and at *b'* one of ammunium silicofluoride. At *d* crystals are shown such as are very frequently formed at the edge of an etching with ammonium fluoride.

A further important question is what part is played by the acidity of the bath. If a {frosting / matt-etching} is produced with the aid of a more strongly acid bath an etching such as is illustrated in fig. 6 *b b'*, is shown on the glass plate, when viewed through the microscope. The grooves between the individual crystal etchings are very wide and divided into entirely trough-like depressed areas. This appearance is only produced by the free fluoric acid, which always widens all the grooves already present into trough-like forms. That this is so can easily be seen if a glass plate, which through use has acquired fine scratches, is etched with dilute fluoric acid and then examined under the microscope. It is then seen that all the scratched grooves have been converted into a chain of successive trough-like depressions, which have exactly the same appearance as the grooves in fig. 6 *b b'*. Since the grooves also become wider thereby, they become much more distinctly visible and it is even possible in this way to produce with aqueous fluoric acid a kind of {frosting / matt-etching} although very weak. It is clear that the grooves will advance all the more towards the crystals and therefore become all the wider the more acid the bath is. Since, however, these troughs owing to their more rounded shape, cannot scatter the light so well as sharp-edged etchings, the {frost / matt} must thereby turn out much finer and more translucent, and in this way the phenomenon is explained that the {frost / matt} turns out the finer the more acid the bath, an observation already made by J. B. Miller (Glasmetzerei). This phenomenon of itself leads me to the above mentioned so-called "clear etching." In the case an already finished {frosting / matt-etching} is subsequently treated once or repeatedly with diluted fluoric acid. If a plate repeatedly treated in this way is brought under a microscope, a picture will be seen such as is shown in fig. 2 of our illustration. The figure mentioned has been taken from a plate deeply etched five times, which plate is of the same origin as the one from which fig. 1 has been prepared. With the aid of the above described methods one may easily ascertain that the polygonal areas visible on the drawing are depressions, whereas the striations between them forming a fine network are elevations. This drawing has been produced from an etching which had the quality of the lower part of fig. 1. In view of what has been premised about the action of the aqueous fluoric acid, there is scarcely any need to give an explanation for the formation of this etching. It is evident that first the grooves

DIE GLASHUTTE"—(*cont.*).

No. 4, p. 51.

between the crystals change in the manner visible in fig. 6 *b*; *b'*, that then the troughs formed continually approach nearer each other, until nothing more of the original crystal etchings is left over than those reticulately connected borders visible in fig. 2. This happens already in the first clear-etching, and the different depressions obtained by repeated clear-etching differ only by the different tones of the troughs and the different acute angularity and different widths of the borders. The last clear-etching appears like the picture of an extremely fine veil made of uncommonly fine threads and which is spread out on a somewhat darker ground. I would also mention that in any case one more transition tone between the simple (frosting / matt-etching) and the first clear-etching might be obtained, if the fluoric acid were allowed to act for a very short time only, whereby a picture similar to fig. 6 *b b'* should be obtained, in which, however, also the crystal pictures themselves would appear as beginning to be etched.

The method of double (frosting / matt-etching) is now to be discussed. This is, of course, effected by removing the crystal coating produced by the first etching, prior to carrying out the second etching. The process going on during this second etching is very easy to understand. The depositing crystals settle down irregularly on the crystal etchings already present, and thereby cause the latter to be intersected by grooves, so that a surface is formed which is covered with very many very small elevations and traversed by numerous grooves of very different depths, which presents a very confused appearance, in which nevertheless it is possible to recognise individual crystal etchings. In view of the extremely troublesome and difficult work, I have refrained from illustrating by a drawing the appearance of such an etching under the microscope. There should be no need for explanation of the fact that a plate etched in this way must appear much (more frosted / matter) and, in transmitted light, much darker than a single (frosted / matted) plate.

The etching baths consisting of alkali fluorides comprise also the so-called etching inks, the purpose of which is to make script appear on glass in (frosted / matt) etching. These inks are liquids which are compounded in a quite similar way to the already described (frosting / matt) baths, but also receive an addition of gum arabic or of precipitated barium sulphate. Obviously the gum serves merely as a thickening agent to avoid running of the script.

It is generally assumed as regards the barium sulphate that it plays the same part. Though this is true, another different significance belongs to it. One may very easily ascertain that the etching comes out much (more frosted / matter) in the presence of barium sulphate than in the absence thereof, which had also already been observed by Stocum (Drugg. Circ. vol. 25, page 84; Chem. Ztg. 1881, page 219). It would be easy to think that the reason for this is that the individual particles of the barium sulphate prevent etching at the place where they lie, and thus many fine elevations would arise. It is, however, easy to recognise with the microscope that this is not the case, and that the only effect of the barium sulphate is this that the crystals become considerably smaller and more numerous. Probably this is caused because a large number of the fine particles of barium sulphate suspended in the liquid, effect a production of very numerous crystals in consequence of the numerous points of contact which crystals can obviously not turn out so large as if from the beginning fewer had been produced.

(Continuation follows.)

"DIE GLASHUTTE"—(*cont.*).

No. 5, p. 61.

Lately some other methods of {frosting / matt-etching} have appeared which however contribute nothing essentially new with regard to the the theory of etching. Pertaining hereto is first of all the so-called dry-etching process of Nienstaedt and O. Lenz (German patent No. 15,590 of the 22nd January 1881; Abridgments of the specifications 1881, page 758). In this method dried and finely powdered alkali fluorides are dusted on to the glass and adhere to those places which had previously been printed or painted with any adhesive which remains damp, or actually a mixture of this adhesive and the alkali fluoride is impressed. Since the alkali fluorides are very hygroscopic, it can easily be understood that in this case also the origin of the {frosting / matt-etching} is due to the formation of crystals. In view of the above statements it is also obvious that this process can only be carried out with acid fluorides and that ammonium fluoride must yield the best results. I have not closely examined Gruene's process, according to which a {frosting / matt-etching} is said to be produced by means of aqueous fluoric acid in such a manner that the glass surface is covered with a coating which does not entirely resist the fluoric acid and is, therefore, partly etched off. (Cf. Industriebl. v. Jacobs, 1879, page 337; Chem. Industr., vol. 2, page 325; Jacobs, Repert., 1879, II, page 112). If this process works at all, it would presumably only produce a very course and uneven {frost / matt}.

Before leaving the subject of {frosting / matt-etching} with the aid of alkali fluorides, I would say a few words on the preparation of the baths themselves. Hitherto their preparation has only been carried out purely empirically, and it is, therefore, easily conceivable that the previous prescriptions are still deficient in some respects. On the one hand, it remains uncertain whether the mixing proportions given in the prescriptions are the most advantageous, on the other hand the prescribed method of preparation is not always the cheapest possible method, which obviously is often very important in practice. One can, of course, only form an opinion on the mixing proportions, if one has a more exact knowledge of the chemical reaction taking place in {frosting / matt-etching}. An entirely accurate opinion would only be possible in respect of each individual case, since the composition of the glass varies; in practice, however it is sufficient to postulate a simple approximate formula of the glass, for example $R_2Si_2O_7$, wherein R represents a monovalent element (cf. Wislicenus, Lehrbuch der Chemie, 1887, I. page 634). The reaction then takes place according to the following equation:

$$R_2Si_2O_7 + 4\,F_2HNa + 10\,FlH = SiFl_6R_2 + 2\,SiFl_6Na_2 + 7\,H_2O.$$

It is evident from this equation that a considerable amount of free fluoric acid must be present if the sodium-fluoride is to be fully utilised. Since this fluoric acid might easily have a harmful effect, it is more advantageous to transfer the task of neutralising the base to another acid. Acetic acid is particularly suitable for this purpose, because it does not decompose the acid alkali fluorides, and is consequently not capable of liberating fluoric acid from them (see Borodine, Compt. rend. vol. 45, page 553). The process then takes place according to the following equation:

$$R_2Si_2O_7 + 9\,F_2HNa + 5\,C_2H_4O_2 = SiFl_6R_2 + 2\,SiFl_6Na_2 + 5\,C_2H_3O_2Na + 7\,H_2O$$

It will be seen that in this process free fluoric acid can never be present and that moreover

the solubility of the silico-fluoride is reduced by the sodium acetate formed. The ratio of sodium fluoride to acetic acid, resulting from this equation is 83 : 50, or approximately 9 : 5. If in place of the acid sodium fluoride the neutral sodium fluoride is employed, the ratio will be 9 : 10, which nearly corresponds to Siegwart's second prescription, which requires 8 : 10 (40 : 50). In considering these figures it must further be borne in mind that the commercial glacial acetic acid will probably never be absolutely anhydrous and that a small excess of acetic acid is quite harmless, so that Siegwart's prescription appears to be entirely serviceable for practical conditions. It is at present not yet possible theoretically to determine the concentration of the baths, which, as already mentioned, plays a very important part, since the solubilities of the compounds in question are too little known. If the rest of the above-mentioned prescriptions is compared with the theoretically deduced proportional numbers, it is found that most of the former differ essentially from the latter. Only Miller's first prescription agrees almost exactly with the theory for potassium fluoride ($KF1_2H$) if the commercial hydrochloric acid is assumed to be 40%. All the other prescriptions contain far too little acid. This might well be attributed to the fact that they do not prescribe acetic acid, but an inorganic acid, which decomposes the alkali flouride completely and not only until an acid fluoride is formed, and which consequently cannot be added in such large quantity as is required by the equation of decomposition. From this it further follows that the alkali fluoride is not fully utilised in such baths and is therefore lost, unless acid is added again after some time. All these drawbacks are avoided, however, if acetic acid is employed.

Regarding the question of the cheapest method of preparation, it will readily be understood that it must be more advantageous to mix fluoric acid with sodium acetate instead of mixing sodium fluoride with acetic acid, whereby the saving may amount to 10-15%. It readily follows from the equation last stated that in this case the addition of some sodium carbonate is required. In order to state numerical proportions, it would be necessary to know the content of the commercial fuming fluoric acid, about which nothing is contained in the literature. One may, however, assume with some probability that it is about 50%. On this hypothesis, about the following proportions would be required for the etching bath: 30 parts fluoric acid (50%), 17 parts of sodium acetate and 9 parts of calcined or 23.4 parts of sodium carbonate crystals. The quantity of the water to be added, if required, would of course have to be ascertained by experiments. Also it would obviously be more correct to determine the content of the fluoric acid (as well as of both the other constituents of the bath) in advance, and to calculate the mixing proportions accordingly. This bath would then entirely correspond to the conditions in practice.

I shall now deal with {frosting / matt-etching} with the aid of gaseous hydrofluoric acid. It has been an old experience that this process yields a very uneven {frosting / matting} and apart from other drawbacks, is, therefore, unsuitable for the preparation of {frosted / matt} surfaces, but it may at most find application for etching in designs. Regarding the theory of this process, there already exists quite generally in the earlier literature—besides the above mentioned opinion of Berzelius—a theory about the cause of the unevenness of this etching, according to which the water condensed on the surface of the glass, which converted into aqueous fluoric acid by dissolution of hydrogen fluoride gas, acts on the glass to dissolve it. The authors of this theory appear to be Tesié du Mothay and Maréchal (Compt. rend., vol. 62, page 301).

If a surface etched with gaseous fluoric acid is examined, a picture somewhat as shown in fig. 3 is seen. At first the figure shows the etched picture of a small hexagonal crystal originating from sodium silico-fluoride. These crystals are very few and one has to look for a long time in order to find some. Besides this, large crystals and crystal aggregates are seen, such as are also illustrated in various other forms in fig. 4. They undoubtedly originate from calcium silico-fluoride (see Haushofer loc. cit.). The size and distribution of these crystals is very unequal. In some places they are large and numerous, in others small and scanty, and again in others small and numerous. The surface between the crystal etchings forms a fine grained base material, which frequently almost exclusively covers individual parts of the glass and then only contains very scanty crystal etchings. In this case the surface is very closely granular and looks as if only consisting of very small crystal skeletons or crystal aggregates. In other places, especially where somewhat larger crystal etchings have been developed, the base surface is almost entirely smooth and contains only a number of small round pits rather far apart. These phenomena might presumably be explained in somewhat the following manner: At the commencement of the etching numerous very small

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"DIE GLASHUTTE"—(*cont.*).
No. 5. p. 63.

droplets, which etch the above mentioned small pits are formed first by condensation of water, which dissolves hydrogen fluoride gas. These droplets gradually flow together to form relatively smaller or larger moist spots, in which the larger crystals may develop. In other places, however, the numerous small droplets form much larger droplets, in which quite small crystal aggregates are formed, which effect the above-mentioned granulation of the ground. One can easily ascertain that the etching will also come out unevenly, if whenever the glass plate becomes slightly moist it is lifted and the moisture allowed to evaporate, so that larger accumulations of liquid cannot form. As the microscopic examination shows, the unevenness is to be attributed merely to a very uneven development of the crystals that can hardly be explained in any other manner than that described above.

(Continuation follows.)

"DIE GLASHUTTE"—(*cont.*).
No. 6. p. 74.

There remains now only the examination of the process which takes place in {frosting / matt-etching} with fluor spar and sulphuric acid. Dingler's pol. Journal (vol. 141, page 184) contains some remarks on this subject by an author, whose name is not given there (from the Kunst and Gewerbeblatt fuer Bayern 1856, page 184) which remarks have been incorporated in many text-books. It is stated there *inter alia* that when employing concentrated sulphuric acid no {frosting / matt-etching} is obtained, and that most advisedly the acid is mixed with water in the proportion 1:4. Further the paste is to be allowed to dry on at 30–40° Reaumur (=37·5–50° C.), in order to obtain a good etching. With regard to this I would remark that with concentrated sulphuric acid I have always obtained {frosted / matt} etchings, which, however, always came out very unevenly owing to the violent development of gas taking place. For obtaining fine {frosted / matt} etchings, the proportion given by the author is actually the best. It is, however, better to use a slightly lower temperature (30–40° C.),

as otherwise an uneven etching may too easily be produced by the formation of gas bubbles.

If a {frosted / matt} glass plate, successfully prepared according to this process, is examined under the microscope, it is seen that the surface of the glass plate is covered with trough-like little pits having circular borders, which lie close together and interlace, and which have very different depths; between these pits island-like raised parts of very broken outlines lie, the surface of which is itself interrupted by individual depressions. This structure can be particularly well recognised, if a microscope attachment for stereoscopic observation is used. More definite ideas about the formation of this surface will only be reached if places are observed, at which the {frost / matt} is not yet fully developed. Pictures such as shown in fig. 5 will then nearly always be seen. The figure is so eloquent that it hardly needs an explanation. At first relatively large island-like elevations* with irregularly round borders are seen, surrounded by one or two grooves. It will be easily seen that these spots are always the places in which a larger piece of fluor spar lay. Through the action of the sulphuric acid fluoric acid was formed in a zone around the fluor spar, and the acid produced the surrounding groove. When the piece had become smaller through the attack of the sulphuric acid, a second groove could be produced, or there were formed small pits or only one trough. The surface between these roundish figures is traversed by numerous small grooves, irregularly reticulately connected, which evidently have been formed exactly as just described, save that very small fragments of fluor spar were active in this case. Actually, a fairly fine powder of fluor spar consists of granules of the most varied sizes. In the powder employed for the above etching, I found numerous granules having a size of 1 to 2μ (1μ=1 micro-millimeter=0·001 mm.), fewer granules up to a diameter of about 150μ and still more sparsely granules up to a size of about 220μ. The large areas of the etching are generally slightly smaller than the largest granules of the powder of fluor spar, which is easily comprehensible, since the etching only takes place when the granules have become slightly smaller owing to the attack of the sulphuric acid. In view of the high acid content of the etching mixture, it will be easily understood that no crystal etchings are formed in this case. There is also no difficulty in explaining the above described appearance of the finished etching. A homogeneous solution of fluoric acid is gradually formed, which etches out the grooves in the above described manner, so that they gradually approach one another, until they finally meet. In place of the larger pieces of fluor spar, fine pulverulent gypsum is probably deposited, thus producing the above mentioned island-like elevations. In order that the process just described be accomplished, it is evidently necessary that the fluoric acid being formed around the small pieces of fluor spar, be not too dilute, since otherwise the local etching proceeds more slowly than the distribution of the fluoric acid in the liquid. Actually with the employment of too dilute acid no etching or only a very slightly {frosted / matt} etching and which appears to be formed only of small pits is obtained.

The field of the problems in question is now fairly exhausted. Though much is still uncertain and not clear, it is hardly possible to deny that our ideas of the processes, with which we have been dealing, have been to some extent elucidated through the microscopic examination. On the other hand practical microscopy itself may profit from the knowledge obtained with its assistance, for with the aid of the microscope it can now be easily ascertained in what way a {frosted / matt-etched} glass was produced which perhaps may occasionally be of practical importance. From this point of view it may not appear superfluous to get to know the appearance of a glass {frosted / matted} by a sand blast when examined under the microscope, and I beg, therefore to refer shortly to this matter, although it is really outside the scope of this paper. The condition of the surface of a glass {frosted / matted} in the manner just described is essentially different from the condition shown by {frosts / matts} produced by a chemical method. The {frost / matt} produced by a mechanical method can with some experience be recognised with the naked eye by its far coarser quality. When examined under the microscope, it is seen that the surface of such a glass consists of innumerable fracture-surfaces of very different direction and size, all of which show more or less distinctly a quality which is designated as conchoidal fracture. It is evident that this appearance is most intimately connected with the formation of this {frosting. / matting.}

* Naturally in this case also I have satisfied myself according to the method just indicated, which parts are elevations and which parts constitute depressions.

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"DIE GLASHUTTE"—(*cont.*).

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Nearly the same condition of surface is also shown by the {frosted / matt} glass produced by grinding.

SPRECHSAAL. Vol. 40. 1907. No. 49.

pp. 665 and 666.

THE ETCHING OF HOLLOW GLASS.

(Reprinting forbidden.)

The etching of glass belongs at present to the most used and favoured methods of decoration used in glass finishing. Apart from the fact that well etched glasses make an excellent impression, this kind of decoration enables the mass production of articles so that glass etching enters the sphere of interest of every glass factory that is concerned with the production of decorated objects.

The etching of glass depends upon the fact that fluoric acid is capable of attacking silicic acid and dissolving it with formation of silicon fluoride, the metals contained in the glass, such as potassium, sodium, calcium, etc., being converted into the corresponding fluorides or silicofluorides. The silicon fluoride moreover is decomposed by water into gelatinous silicic acid and hydrofluosilicic acid which for its part combines with the bases and settles as a white coating on the etched glasses.

According to the object to be attained by the etching, the procedure is different and correspondingly a distinction is drawn between {frosting / matt etching} and relief etching. By the first the whole surface of the glass is uniformly {frosted / matted} by the second raised or depressed patterns are produced on the glass. Generally by etched glasses only those ornamented in the last mentioned way are understood, on the other hand the uniformly matt glasses are, for short {termed frosted. / designated as matted.}

In order to provide glass with a {frosted / matt} surface, fluoric acid is not used alone but in combination with potassium fluoride. The {frosting / matting} action of this mixture, called a {frosting / matt} bath, depends upon the fact that the fluoric acid attacks the glass surface and that the potassium silico fluoride deposits itself in the rough surface in the form of fine crystals which by scattering of light give the {frosted / matt} effect. The {frosting / matt} bath is constituted according to the most varied prescriptions but must always be suited to the glass if it is to give good results. A {frosting / matt} bath which operates well is prepared for example in the following way: A weighed out quantity of concentrated fluoric acid is diluted with water in a wooden tub in the proportion of 1:20 and mixed with so much 90% potassium carbonate until the acid is just neutralised. This is to be recognised by the fact that no more effervescence occurs. Then for each part by weight of fluoric acid employed, a further ½ part by weight of concentrated fluoric acid is added. The bath is immediately ready for use.

In order to obtain a beautiful uniform {frost / matt} it is absolutely necessary that the glass should reach the {frosting / matt} bath completely clean. For this purpose it is first washed in water and freed from any adhering grease in a so-called preliminary bath which consists of very dilute fluoric acid. Only after this cleaning is the glass passed into the {frosting / matt} bath which now acts on the completely clean glass surface. After 25-30 minutes the {frosting / matting} is completed and the glass is cleansed completely of the resulting coating in hot water. Frequently the {frosted / matted} glass is dipped into a mixture of hydrochloric and acetic acid in order to remove the coating more easily. If sufficiently hot wash

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water is employed, however, this operation is unnecessary.

In order that the {frosting / matting} may proceed favourably it is also of advantage if it is carried out in a warm room which is particularly to be observed in the winter months.

In time the {frosting / matt} bath loses its {frosting / matting} effect and must be regenerated. For this purpose the bath is allowed to settle and the clear liquid standing above the sediment is siphoned off. To each 5 litres of this liquid, 1 litre of concentrated fluoric acid is added whereupon the bath can be used again. The glasses which have been {frosted / matted} in the manner above described are frequently subjected to another etching which proceeds further whereby their surface becomes more lustrous and receives a silk-like appearance. This finish is termed satin etching or silk matt. It is achieved by over-etching the {frosted / matted} glass, after it has been cleaned from the coating, in fluoric acid which is diluted with water in the proportion 1 :5, and indeed this over-etching can be repeated several times whereby the silk-like lustre is increased. After this over-etching the glass is washed in hot water, if it is over-etched several times the glass must be cleaned thoroughly each time, since otherwise it becomes spotty.

The production of {frosted / matted} or satin finished glasses is as simple as the manufacture of etched glasses is complicated, i.e., of those which show raised or depressed patterns. Here two kinds are to be distinguished: 1. Bright or plain etching in which the glass exhibits lustrous deepened decorations the same as its natural colour, as is the case with pantographed, guilloched and brightly etched glasses; 2, {frosting / matt etching} proper in which raised or deepened decorations are visible on a {frosted / matt} glass ground.

The plain or bright etching is almost exclusively used in the decoration of table ware. When the patterns to be produced are drawn by the guilloching machine or the pantograph, the finished cut glass is dipped into molten wax, which produces on the glass a thin, and after cooling, rigid covering film. Into this the desired design is engraved by means of the needles of the above mentioned machines, whereupon the glass, weighted with water or lead shot is placed in the etching bath. This consists of concentrated fluoric acid which is filled into a lead lined wooden box to such a height that the design to be etched is completely covered by the acid, which must not, however, get into the interior of the glasses. From this it can be already concluded that invariably only glasses of equal heights can be simultaneously etched. In order to be able to etch objects of different heights at the same time, the same have also to be completely coated internally with a protecting coating of wax.

In order to render possible rapid insertion and removal of the glasses they are placed on a tray made of wooden laths fitted with handles, and dipped by means of this into the etching bath. By this means it is possible to etch all the glasses for an equally long time which otherwise would not be readily possible. The etching is finished after 15-20 minutes, and the glasses are dipped in hot water to remove the layer of wax. The wax melts off, collects on the surface of the water, is skimmed off, and can then always be employed again. The design appears as a deepened, strongly light refractive design, as bright as crystal, on the glass. If patterns are to be etched which cannot be prepared at all, or only with difficulty, by means of the guilloching machine or the pantograph, the printing-off process is employed in which copies are prepared from designs etched on zinc or steel plates and transferred to the glass. An accurate description of this process is given under Relief Etching, in which this process is employed exclusively.

While in the plain or bright etching the designs to be produced are fixed on the smooth shiny glass surface by means of one of the above described methods, in the case of true {frosting / matt etching} also called relief etching, the glass surface

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While in the plain or bright etching the designs to be produced are fixed on the smooth shiny glass surface by means of one of the above described methods, in the case of true {frosting / matt etching} also called relief etching, the glass surface is first {frosted / matted} by means of the sand blast or {frosting / matting} bath and then only is the pattern transferred to the {frosted / matt} surface.

{Frosting / Matting} by means of the sand blast is accomplished in the sand blast machines or sand jet blowers, of which various constructions exist. According to the more modern systems a fan sucks a current of air, into which the dry sand is fed, whereby the latter is carried along and on its

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way impinges against the rotating glass article, the surface of which is scratched by the sand grains impinging on it with great force and is thus {frosted / matted}.

The sand blast machine, just mentioned briefly, is in accordance with its method of working, also called the dry sand blast machine, to distinguish it from the wet sand blast machine, which throws against the glass, not dry sand but a fine sand slime by means of a jet of steam. The {frosting / matting} which these wet sand blasts produce is considerably finer and more uniform than that of the dry blast, but its use is limited by the fact that considerable breakage is caused because the steam heats the glass strongly and suddenly.

The efficiency of the sand blast is quite considerable so that at the present time the other methods of {frosting / matting} for relief etching are of only slight importance, and are only employed in small factories in which motor power for driving the sand blast is lacking.

{Frosting / Matting} by means of the {frosting / matt} bath has already been described in detail, and it only remains to be mentioned here that very occasionally {frosting / matting} is also practised by means of the spreading {frost / matt}, a mixture of ammonium fluoride, potassium fluoride and fluoric acid, which, however, is very expensive and cumbersome.

When the glass has been {frosted / matt-etched} in one or other of the described methods, the transfer to the glass of the pattern to be etched is begun.

As already mentioned, in relief etching, the printing-off process is employed exclusively. According to this method the designs to be produced are etched on in zinc or steel plates, which is accomplished by means of dilute nitric acid. The whole plate is first covered with asphalt paint and the pattern to be etched removed from the asphalt ground by means of oil of cloves. The plate is then etched, and now always contains the negative of the desired design, and there are therefore places deepened on the plate which are intended to remain in relief on the glass and vice versa. The plate engraving requires great skill and experience; if the plate is too lightly etched, weakly coloured printings are obtained which must be strongly improved subsequently; if the etching turns out too deep the copies contain too much paint which on printing is flattened on to the glass whereby indistinct blurred outlines result.

When the plate is completely etched the manufacture of copies can be commenced. For this purpose the printing ink is spread on to the steel plate by means of a spatula, in such a manner that the etched-out pattern is completely filled with ink; the excess ink is wiped off. A piece of tissue paper corresponding in size to the pattern is then laid on the plate and rolled by means of a press. If the paper is then carefully pulled off from the steel plate, the pattern in ink is thus obtained on the paper which is then pressed with the ink side against the glass and moistened with water; the paper can now be removed very readily and the pattern to be etched remains adhering to the glass. The printed glass is further touched up with asphalt paint and painted over on the inside in order to prevent the attack of the fluoric acid there. After this coating is dry the glass can be etched. This is accomplished in lead lined wooden boxes which are placed in well ventilated rooms and contain the etching bath, which is prepared by diluting concentrated fluoric acid to 1:4 to 1:5. The glasses are placed in the acid

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means of oil of cloves. The plate is then etched, and now always contains the negative of the desired design, and there are therefore places deepened on the plate which are intended to remain in relief on the glass and vice versa. The plate engraving requires great skill and experience; if the plate is too lightly etched, weakly coloured printings are obtained which must be strongly improved subsequently; if the etching turns out too deep the copies contain too much paint which on printing is flattened on to the glass whereby indistinct blurred outlines result.

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Defendant's Exhibit D-3.

ON THE RELATION BETWEEN THE PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF GLASS
VII — ETCH FIGURES

By Edwin Ward Tillotson, Jr.

Received June 21, 1917

When glass is exposed to the vapor of hydrofluoric acid, or dipped in a solution of hydrofluoric acid, with or without the addition of soluble fluorides, the surface is etched unevenly, there being produced "etch figures" of varying forms, and more or less crystalline in appearance.

An explanation of the formation of these figures was first offered by Leydolt,[1] who supposed them to be due to "preëxisting crystals" in the glass, for the figures obtained by etching with hydrofluoric acid and also with steam possessed a remarkable similarity to crystal forms. This work was repeated in 1857 by Daubree,[2] who found no evidence for pre-existing crystals, and explained the figures as being produced by a protective coating of insoluble substances, such as K_2SiF_6, which might be deposited locally on the surface of the glass. In 1866, an exhaustive study of this phenomenon was carried out by Weatherill,[3] who observed that, in general, these etch figures were in relief and therefore supported the protective-layer theory; but, in one instance, a star-shaped acicular figure was found to be etched out, and this was regarded as disproving the view set forth by Daubree. Reinitzer[4] noticed that the crystal form of the etch figures corresponded to that of the insoluble substances which might be formed, such as potassium or calcium fluosilicates, and therefore supposed them to be due to the formation of these substances on the surface of the glass. He also observed, as further evidence of this protective action, that concentrated HF, and HF and H_2SO_4 did not form etch figures, since these reagents were sufficiently active to dissolve both glass and the insoluble substances. Jackson and Rich[5] attempted to correlate the etch figures with lack of homogeneity of the glass. They demonstrated by differential flotation of glass powders that ordinary glass is not homogeneous; but were unable, by the method employed, to detect any lack of homogeneity in optical glass. Nevertheless etch figures were obtained with optical glass as well as with the more common kinds. Lately Frink[6] has announced that it is possible to differentiate between good and faulty glass by reason of differences in the etched surfaces produced by hydrofluoric acid, and to determine whether the fault is due to chemical inhomogeneity or to mechanical strains. Frink also inclines to the view that these figures are caused by preëxisting crystals.

There are, therefore, two well defined opinions regarding the cause of the mat-etch: the one supposes "preëxisting" crystals within the glass, while the other is based on the protecting action of insoluble fluorides and fluosilicates formed during the etching process.

It seemed distinctly worth while that this question should be settled, not only because of its importance in the practical etching of glass, but also for whatever bearing it might have on the theory of the molecular structure of glass. A series of experiments was accordingly carried out in the endeavor to throw more light on this subject.

MATERIALS

The materials used in this investigation were C. P. hydrofluoric acid, containing about 45 per cent HF, and C. P. ammonium fluoride. The etching solutions were prepared in platinum dishes, and the ingredients were weighed with an accuracy of about 1 per cent.

The following glasses were available and were used:

Window glass	Potash-lead glass for cutting	Fused silica
Plate glass	Borosilicate laboratory glass	Microscope slides

The microscope slides were from an unopened box and were therefore presumably uniform in composition. These slides also approached more nearly to optical glass in homogeneity than the other glasses which were used.

EXPERIMENTAL

The first series of experiments was made with the microscope slides, using etching solutions varying in composition from pure hydrofluoric acid, to a solution[1] of hydrofluoric acid saturated with ammonium fluoride. The etching solution was applied by immersing the slides in the solution.

Figs. 1 to 6 show photomicrographs of this series enlarged 60 diameters. It should be mentioned that a very troublesome optical illusion is associated with these etch figures both under the microscope and in the photographs. At one instant they appear as "pits" in the glass, and at another instant they appear to be protuberances or pyramidal figures projecting outward from the surface of the plate. The figures under the writer's observation have been without exception "in relief," as noted by Weatherill; that is, they are protuberances and not pits.

In examining Figs. 1 to 6, it is apparent that pure hydrofluoric acid dissolves the glass, in general, evenly, and with the production of only occasional etch figures. When, however, the amount of ammonium fluoride is increased, the etch figures become more and more definite in shape. For low concentrations of ammonium fluoride, as shown in Fig. 2, the etch figures are suggestive of acicular crystals, but, with higher concentrations, the figures become more nearly equilateral and "granular" in appearance. It is of interest to note that the shape of the etch figures is not materially altered by increasing the amount of ammonium fluoride beyond the molecular ratio, $NH_4F.2HF$.

When these solutions are made up into a paste with an inert filler, the character of the etch is changed in the direction of producing a finer grain, that is, the

[1] *Wien. Akad. Ber.*, **8**, 261; *Compt. rend.*, **34** (1852), 565; *Pogg. Ann.*, **85**, 104; **138**, 494.

[2] *Compt. rend.*, **45** (1856), 792.

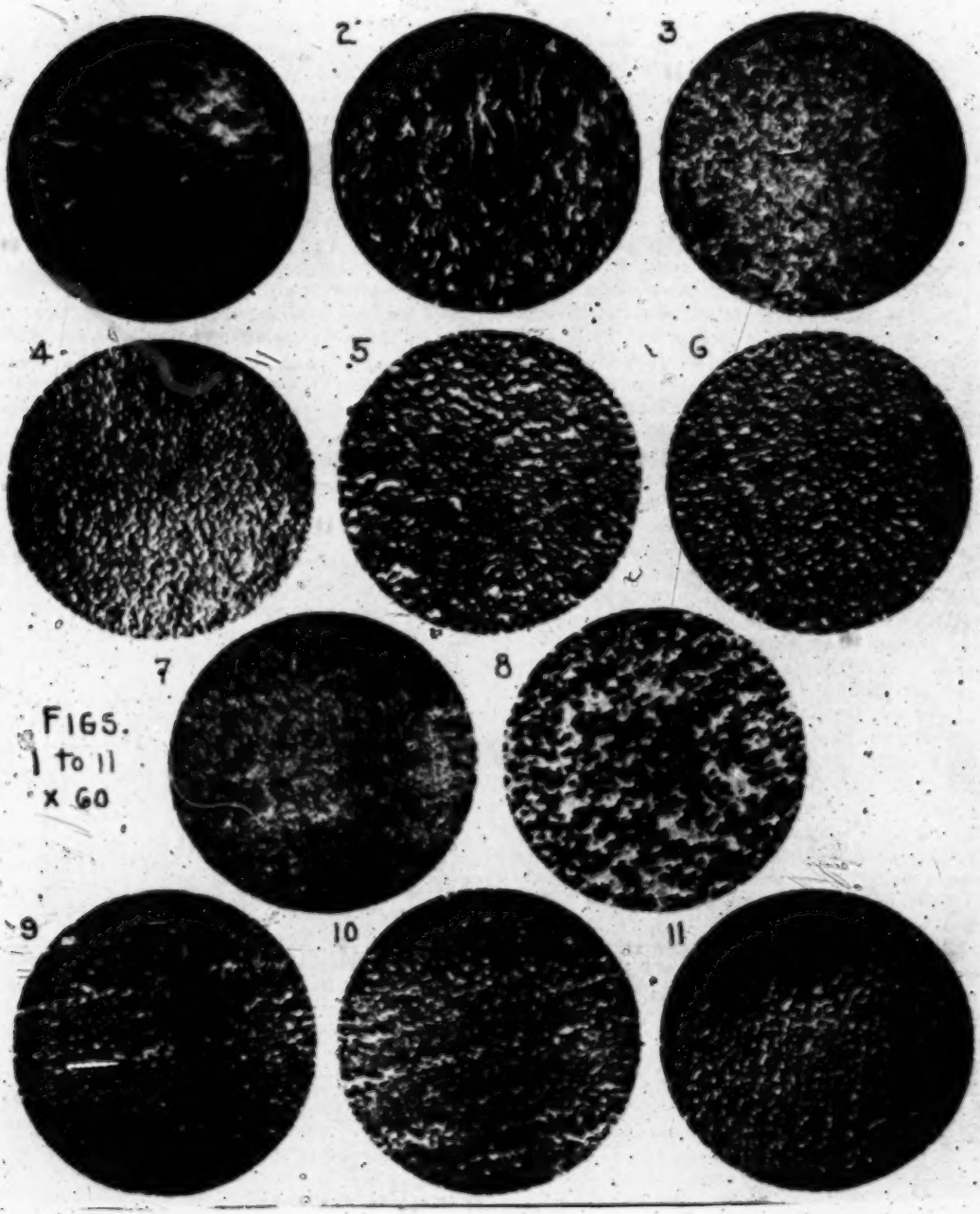
[3] *Am. J. Sci.*, [2] **41** (1866), 16.

[4] *Dingler's polytech. J.*, **268** (1866), 322.

[5] *J. Soc. Chem. Ind.*, **20** (1901), 555.

[6] *Trans. Am. Ceram. Soc.*, **11** (1909), 299; **14** (1912), 662; **15** (1913), 715; *Trans. 8th Int. Cong. Appl. Chem.*, **8** (1912), 37.

[1] About two parts by weight of 45 per cent hydrofluoric acid are necessary to dissolve one part of ammonium fluoride. When the quantity of ammonium fluoride exceeded this proportion, the mixture was used without separating the liquid from the undissolved salt.



MICROSCOPIC SLIDES ETCHED WITH SOLUTIONS VARYING IN COMPOSITION FROM PURE HYDROFLUORIC ACID TO A SOLUTION OF HYDROFLUORIC ACID SATURATED WITH AMMONIUM FLUORIDE

ETCHING SOLUTIONS	FIG. 1	FIG. 2	FIG. 3	FIG. 4	FIG. 5	FIG. 6	FIGS. 7 TO 11
Hydrofluoric Acid:	All	5 parts	5 parts	5 parts	5 parts	5 parts	Same as
Ammonium Fluoride:	None	1 part	3 parts	5 parts	10 parts	20 parts	Fig. 4

FIG. 7—ETCHING SOLUTION MADE WITH A PASTE WITH FLOUR

FIG. 8—ETCHING SOLUTION DILUTED WITH WATER

FIGS. 9 TO 11—ETCHED SURFACE IMMERSED IN DILUTE HYDROFLUORIC ACID FOR

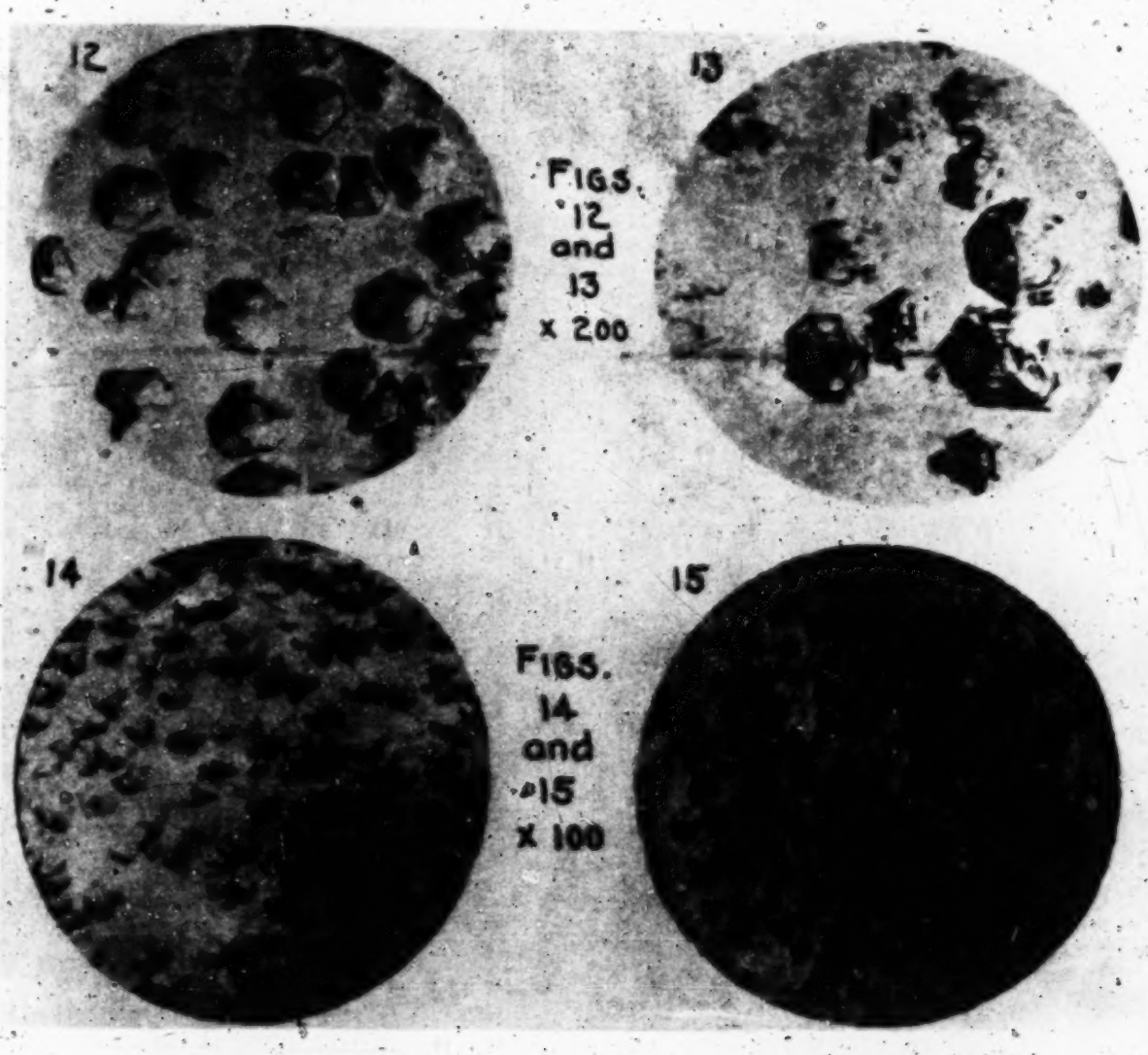
Fig. 9	Fig. 10	Fig. 11
15 sec.	30 sec.	60 sec.

etch figures are smaller and more numerous. This is illustrated in Fig. 7. In general, too, the more concentrated the etching solution the smaller will be the etch figures. Fig. 8 shows the result obtained by diluting a concentrated solution (Fig. 4) with an equal weight of water. The result is to the eye a coarse and sandy surface, which, under the microscope, shows widely scattered etch figures possessing striking geometrical shapes.

It has been pointed out (Fig. 1) that a plane glass surface dissolves substantially evenly and uniformly in pure hydrofluoric acid. When an etched surface, as shown in Fig. 5, is immersed in a solution of hydrofluoric acid, a similar action takes place. Figs. 9 to 11 illustrate such action for one-quarter, one-half and one minute immersion in a solution of equal parts of concentrated hydrofluoric acid and water. That this result is a necessary consequence of uniform solution by the acid may be demonstrated geometrically. The first effect as shown in Fig. 9, is an enlarging and rounding out of the "valleys," finally resulting, as shown in Fig. 11, in a series of smooth "saucer-like" depressions. This operation, which changes in so profound a way the character of the glass surface, is made evident to the naked eye only as a slight decrease in the opacity of the glass. It should also be mentioned that similar depressions are occasionally observed when certain unetched glasses are immersed in pure hydrofluoric acid. This phenomenon is characteristic of mechanically polished glass surfaces, and of the resistant borosilicate glasses; and, because in such cases these depressions appear in lines or rows, it seems probable that they result from minute scratches in the glass surface. They are therefore not true etch figures since they result from a secondary action on a non-uniform surface.

It was observed in general that all solutions which produced a mat etch, as in Figs. 4, 5 and 6, when diluted, produced etch figures resembling true crystals, as shown in Fig. 8. Such a diluted solution was therefore employed with the several varieties of glass mentioned above. The etching solution was made up as follows: Ammonium fluoride 5 grams, hydrofluoric acid (42 per cent) 10 grams, water 10 grams.

Figs. 12 to 18 are photomicrographs, enlarged 100 and 200 diameters, of window glass, plate glass,

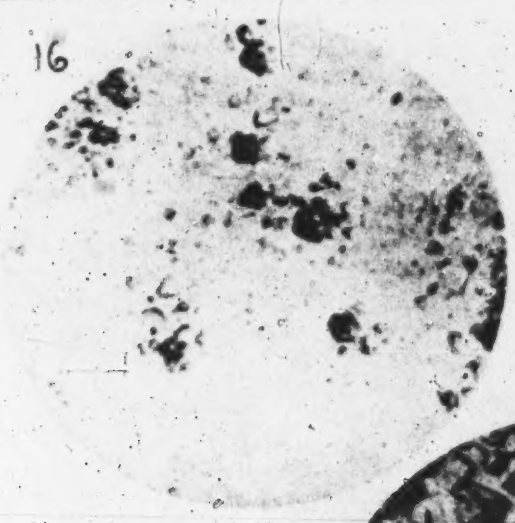


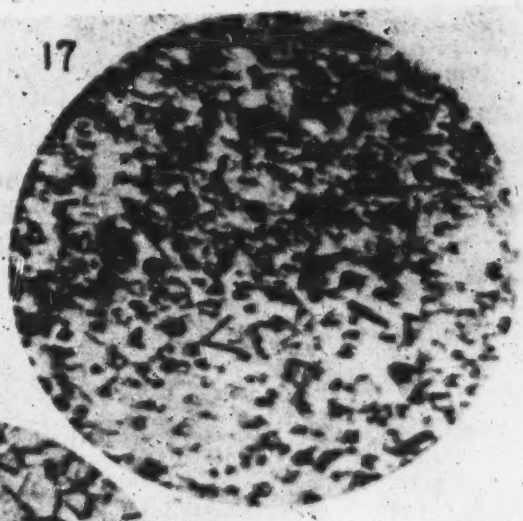
FIGS. 12 AND 13—WINDOW GLASS FIG. 14—PLATE GLASS FIG. 15 POTASH-LEAD GLASS

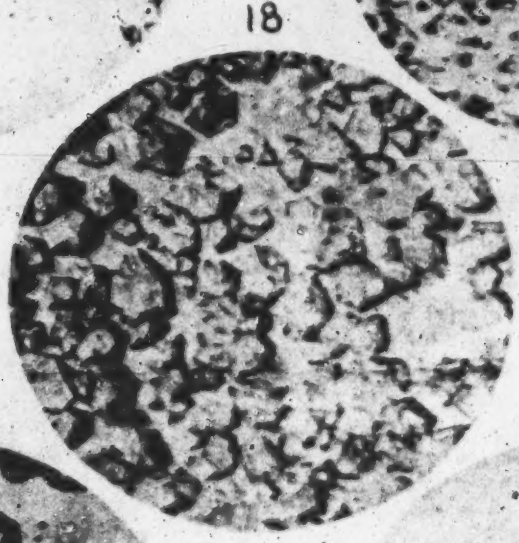
potash-lead glass, laboratory glass and fused silica glass, etched in the solution given above. It is evident that the etch figures of all of these glasses are surprisingly similar in appearance. This makes it difficult to explain these results on the theory of "preëxisting" crystals, especially when account is taken of the wide differences in the compositions of the glasses.

Certain differences are noticeable, however, which in the light of later knowledge support the theory given above. The most noticeable difference is with the borosilicate laboratory glass (Fig. 17) and with the potash lead glass (Fig. 18).

The final explanation for the formation of the figures was secured as a result of watching the







FIGS. 16 to 18
× 100

FIG. 19 × 40
FIG. 20 × 200

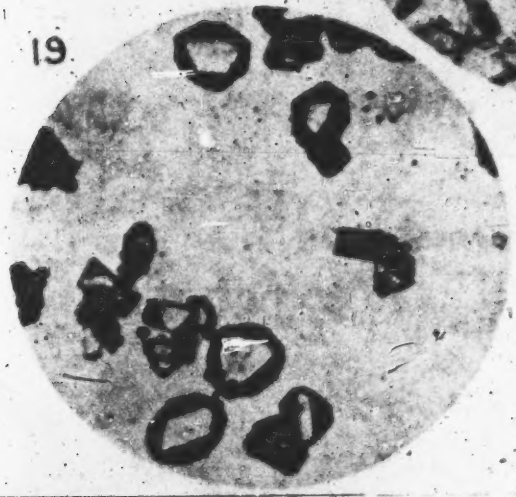


FIG. 16—LABORATORY GLASS (foreign)
FIG. 17—LABORATORY GLASS (domestic)
FIG. 18—FUSED SILICA GLASS
FIG. 19—ARTIFICIAL FLUORESCENT CRYSTALS
FIG. 20—WINDOW GLASS (6- and 8-sided figures)

The facts brought out by these experiments appear to be, broadly, as follows: *The form of the etch figures is independent of the chemical composition of the glass, and is determined by the composition of the etching solution.*

This generalization speaks for the protective coating theory, and against the preëxisting crystal hypothesis.

microscope, the etching process. The solution was applied to the glass plate in the form of a hanging drop and was viewed through the plate from above in order to avoid as far as possible any corrosion of the microscope lenses. Within a few seconds after the solution came into contact with the glass, a great many small transparent crystals appeared floating in the solution.

These were in general of the same shape as the etch figures and increased rapidly in size as the etching proceeded. A certain percentage of these crystals was stationary and occasionally a moving crystal was seen to stop suddenly, as though it had become attached to the glass surface. Both the floating and stationary crystals grew rapidly in size as the etching proceeded. When the plate was then cleaned, etch figures of the size and shape of these stationary crystals were observed in their places. From this it appears that the etch figure is produced by the protective action of crystals which are formed as the etching proceeds.

The composition of the deposited crystals was then investigated. From the fact that etch figures were formed on fused silica (Fig. 18), it was suspected that the crystals consisted of ammonium fluosilicate. Ammonium fluosilicate was therefore prepared by partially neutralizing fluosilicic acid with ammonium hydroxide. A finely crystalline precipitate was obtained, which, on examination under the microscope, appeared identical with the crystals formed during the etching process. These are illustrated in Fig. 10. Analysis showed them to be ammonium fluosilicate:

	Calculated for $(NH_4)_2SiF_6$	Found
Per cent NH_3	19.09	18.76 and 19.04

This substance crystallizes in the regular system, and, in general, the individual crystals are cubes modified by octahedral and dodecahedral faces.

As has been pointed out, the etch figures result from two simultaneous actions: the solution of the glass, and the growth of the crystal which is in mechanical contact with the glass surface. The etch figures are therefore neither pseudomorphs nor casts; and, consequently, can not be expected to be exact duplicates of the crystals. They are essentially silhouettes of crystals which are constantly growing. The figures often show striations normal to the direction of growth of the crystal (Fig. 13), which suggests that possibly the crystal growth or perhaps the solvent action is subject to rhythmic disturbances.

It has been observed that the etch figures are commonly hexagonal in appearance and it might be expected that other shapes should predominate if they were the result of the protecting action of cubic crystals. It is evident that, if the octahedron were in contact with the glass surface, and if the cubical and dodecahedral faces were to develop simultaneously, a hexagonal figure should result. This is apparently what occurs in the majority of cases, and no explanation, except that of hazard, can be offered to account for it. It is to be expected that etch figures of triangular, square and octagonal outline should also be formed, and these figures are nearly always observed in limited numbers (Figs. 12, 13, 14, 18 and 20).

If this theory is correct, it is to be expected that the presence of other metals which form insoluble fluosilicates, will produce characteristic etch figures in accordance with their crystalline habit. This is illustrated in the case of the potash-lead glass (Fig. 15); the etch figures are decidedly characteristic of potassium; and, so far as the writer has observed, *they are always produced by an etching solution which contains potassium, irrespective of the composition of the glass.* The laboratory glasses (Figs. 16 and 17) also illustrate some characteristic figures. These glasses were free from potash, but contained considerable percentages of boric acid, alumina and zinc oxide, and are extremely resistant to the action of the etching solution. As will be seen from the photomicrographs, the habit of these figures is "tabular" with square and triangular forms predominating, but six- and eight-sided figures are not uncommon. This theory also indicates that, if the etching solution contains no substance which produces insoluble fluosilicates or fluorides, the glass should be dissolved evenly, as with hydrofluoric acid alone, and without characteristic etch figures. This was found to be the case when the solution consisted of the acid fluorides of sodium, lithium, aniline, pyridine, zinc and urea. It is therefore apparent that the glass, *per se*, is dissolved evenly and as a whole by the etching solution, *whatever the composition of the solution may be;* and that the matness and etch figures result from a secondary protective action of whatever insoluble materials are formed in contact with the glass surface. The character of the etch figures will be determined by the most insoluble substance deposited; and this perhaps explains the results obtained with acid ammonium fluoride and the potash glass, and also with the borosilicate laboratory glass.

SUMMARY

From the foregoing it is concluded that:

I—All glasses dissolve evenly in acid fluoride solutions.

II—Matt etches and etch figures are obtained only when insoluble substances are formed in contact with the glass surface, and when the solution of the glass in such local areas is thereby prevented.

III—When the etching solution is acid ammonium fluoride, crystals of ammonium fluosilicate form the protecting material.

IV—The etch figures result from a solution of the glass and the growth of crystals, deposited from the solution, in contact with the glass surface. Both reactions take place simultaneously.

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THE DETERMINATION OF IRON IN GLASS SAND

By John B. Ferguson

Received July 26, 1917

One of the absolute essentials in the manufacture of optical glass is a supply of good glass sand, and one of the indispensable attributes of such a sand is a minimum iron content. In searching for such a sand one is compelled to rely on chemical analysis, and now that the problem of optical glass has become a question of national importance it is essential that no errors be made in the seemingly simple determination of the iron in a sand.

In the past, sand analyses generally have shown too low an iron content and since the Geophysical Laboratory has taken up the problem of optical glass, this has been the source of some rather vexatious

SPRECHSAAL 1906. No. 21, p. 904.

ENQUIRY SECTION.

GLASS.

135. I want to { frost hollow glasses quite lightly. / etch hollow glasses quite lightly matt. } What is the method? I have heard of a composition in which washing soda is employed.

SPRECHSAAL 1906. No. 22, p. 950.

To question 135. Crystallised sodium carbonate, washing soda, is a constituent very often employed in the production of {frosting / matt etching} baths. The {frosting / matt} bath is produced by pouring fluoric acid into a wooden vessel painted with asphalt varnish and carefully adding to this perfectly clear dry sodium carbonate in small quantities only. The sodium carbonate dissolves in the acid with vigorous effervescence which almost completely ceases upon further addition of sodium carbonate. As soon as this weak effervescence commences no further addition of sodium carbonate should be made. The fairly thick solution is now diluted with about 4-5 times as much water. Before using, the mixture is allowed to stand for one or two days so that the constituents have time to combine really intimately with each other, whereby the action of the bath is improved. If the etching when tested is too strong, more water is added. The glasses to be {frosted / matted} must, before being dipped into the {frosting / matt} bath, be pre-treated in a weak fluoric acid solution, 1 part acid, 15-18 parts water, whereby any greasy factory soot or other impurities are removed and the {frosting / matt etching} turns out uniformly. Also warming the {frosting / matt} bath is of great utility. After etching, the glasses are washed with warm water. If the glasses are only to be {frosted / matted} on the outer surface the openings must be covered with wooden plates coated with rubber. In the case of light {matting / frosting} however the inside and outside are usually {matted / frosted}

Second answer. Washing soda, sodium carbonate is used for the production of sodium fluoride, by adding to fluoric acid, sodium carbonate until effervescence ceases, whereupon the mixture is evaporated. In the following a very serviceable {frosting / matt} bath is given:

Hydrocholoric acid	200 g.
Potassium sulphate	150 g.
Sodium fluoride	300 g.
Water	600 g.
Hydrofluoric acid	150 g.

The use of only distilled water is recommended.

ZEITGEMASSE, HERSTELLUNG, BEARBEITUNG UND VERZIERUNG DES FEINEREN HOHLGLASES (HOHLBAUM 1910), PP. 234-236 (PRESENT DAY MANUFACTURE, WORKING UP AND ORNAMENTATION OF FINER HOLLOW GLASS).

GLASS ETCHING.

Glass etching has for its object to render the glass matt {frosting / matt-etching} or to etch out coloured designs on layered glass (deep etching). Glass etching depends on the action of fluoric acid and of alkali fluorides to dissolve silicon compounds and therefore glass with formation of fluorides, e.g.:

$$\underbrace{K_2O + CaO + 6\,SiO_2}_{\text{Glass}} + 24\,HF = 2\,KF + CaF_2 + 6\,SiF_4 + 4\,H_2O$$

The resulting fluorides react among themselves to produce insoluble compounds such as potassium silicofluoride, calcium silicofluoride which salts settle on the glass in the form of a white loosely adhering layer and hinder the further action of the fluoric acid. These salts which are called fluorsilica (fluorkies) must be removed from time to time during deep etching by brushing off or the settling of these salts must be prevented as far as possible by setting the glasses in motion during the etching.

{Frosting. / Matt-etching.}

If a solution of alkali fluorides with an addition of a certain quantity of fluoric acid is allowed to act on glass the fluoric acid etches the glass and the resulting silicon fluoride forms hydrofluosilicic acid H_2SiO_4 (Sic) with the water. The potassium fluoride formed at the same time and present in the solution forms with this acid, insoluble potassium silicofluoride and hydrogen fluoride:

$$\underset{\text{(Sic)}}{H_2SiF_6} + 2\,KF = K_2SiF_6 + 2\,HF.$$

This freshly produced hydrogenfluoride etches again whilst the insoluble potassium silico-fluoride settles on the etched parts in the form of fine firmly adhering crystals. These crystals produce a rough surface which scatters light so that the glass appears matt white.

Potassium silico-fluoride produces the most beautiful {frost / matt}; consequently potassium fluoride is often used for the production of a silk like {frost / matt} such as is very suitable for hollow glasses.

Ammonium fluoride acts more rapidly than potassium fluoride; it produces however a rougher {frost / matt}

ZEITGEMASSE, HERSTELLUNG, BEARBEITUNG UND VERZIERUNG DES FEINEREN HOHLGLASES (HOHLBAUM 1910), PP. 234-236 (PRESENT DAY MANUFACTURE, WORKING UP AND ORNAMENTATION OF FINER HOLLOW GLASS)—(*cont.*).

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Often solutions of potassium fluoride and ammonium fluoride are used, by means of which mixtures a {frost / matt} of any desired grain can be obtained according to the quantity of the individual salts. Often an addition of potassium sulphate or ammonium sulphate is made to the {frosting / matt} bath in order to obtain a beautiful crystal formation, and further hydrochloric acid or sulphuric acid instead of fluoric acid is added. These acids produce from the fluorides in the bath, hydrogen-fluoride which starts the etching:

$$KF + HCl = KCl + HF$$

This quantity of hydrogen fluoride however is bought more cheaply as fluoric acid than as the dear alkali fluorides so that it is more rational to add fluoric acid to the bath.

Potassium fluoride one usually prepares oneself more cheaply by saturating fluoric acid with potassium carbonate.

{Frosting / Matt} Baths.

No. 1 for light {frost / matt}		No. 2 for {satin / silk} matt.	
Fluoric acid	10 parts	Water	100 parts
Water	100 ,,	Potassium fluoride ...	10 ,,
Potassium Carbonate until saturation is reached.		Hydrochloric acid ...	1 part.
Fluoric acid	2 ,,	To be used at 40-60°C.	
This bath acts well at normal temperature.			

This {frosting / matt} bath is mainly used for producing a fine {frost / matt} on high quality articles for lighting purposes. The articles are {frosted / matted} in it without using a preliminary bath.

Since the bath must be warmed it is kept in a wooden vat in which is a leaden coil through which steam flows.

No. 3 for very rough {frost / matt}

Water	5 parts.
Ammonium fluoride	5 ,,
Fluoric acid	2 ,,

This bath acts very rapidly even at ordinary temperature. It is sufficient to brush the article with this bath with a bristle paint brush in order to render it {frosted / matt}. This {frost / matt} is therefore called brushing {frost. / matt.}

It is obvious that apart from the baths quoted other {frosting / matt} baths can be made up as required in order to obtain with them a {frost / matt} of the desired grain

{Frosting. / Matt-Etching.}

In order that the {frosting / matt} bath may act well it is necessary that the surface of the glasses should not be contaminated with substances which hinder the action of the bath. The glasses are cleaned most

ZEITGEMASSE, HERSTELLUNG, BEARBEITUNG UND VERZIERUNG DES FEINEREN HOHLGLASES (HOHLBAUM 1910), PP. 234-236 (PRESENT DAY MANUFACTURE, WORKING UP AND ORNAMENTATION OF FINER HOLLOW GLASS)—(*cont.*).

p. 236.

simply by lightly etching them in a bath which consists of dilute fluoric acid. This bath is called the preliminary bath.

PRELIMINARY BATH.

Fluoric acid concentrated 70%	1 part.
Water	6 parts.

The articles are etched in the preliminary bath for about 10 minutes and are then immediately transferred to the {frosting / matt} bath where they are left also for about 10 minutes. After {frosting / matting} in the {frosting / matt} bath the articles are placed into a container of warm water so that the salt crust adhering to the surface is loosened and then into another container of hot water. When the glasses are clean they are placed on a lath framework where they dry at once since the hot water adhering to them quickly evaporates. The water in the containers is warmed by steam which is passed through the water in lead tubes. The water must be changed several times a day.

ZEITGEMASSE, HERSTELLUNG, BEARBEITUNG UND VERZIERUNG DES FEINEREN HOHLGLASES (HOHLBAUM 1910), PP. 234-236 (PRESENT DAY MANUFACTURE, WORKING UP AND ORNAMENTATION OF FINER HOLLOW GLASS)—(*cont*:).

p. 240.

Production of strongly {frosted / matt} patterns on a less {frosted / matt} ground.

This kind of decoration is mostly used for articles for lighting purposes such as lamp globes, electric incandescent bowls, etc In order to produce such patterns the article is strongly {frosted / matted} by means of the sand blast. The pattern in question is printed on to this {frosted / matted} article and after drying the parts not printed are etched brighter in a deep bath.

ZEITGEMASSE, HERSTELLUNG, BEARBEITUNG UND VERZIERUNG DES FEINEREN HOHLGLASES (HOHLBAUM 1910), PP. 234-236 (PRESENT DAY MANUFACTURE, WORKING UP AND ORNAMENTATION OF FINER HOLLOW GLASS)—(*cont.*).

p. 255.

Production of strongly {frosted / matt} patterns on a less {frosted / matt} ground.

Production of strongly {frosted / matt} patterns on a less {frosted / matt} ground. This decoration which finds the widest application in the industry concerned with glass for illumination is produced by {frosting / matting} the whole article, for example a lamp bulb, uniformly with a sand blast. The pattern is then printed on to the {frosted / matted} bulb with a covering paint and after the paint has dried the bulb is etched in a deep etching bath. The background becomes brighter by reason of the etching and acquires a silk like appearance. Since by reason of the etching in the deep etching bath the pattern is raised, the latter stands out still more sharply from the background which only further improves the good appearance.

SPRECHSAAL. No. 48. Vol. 45. p. 741.

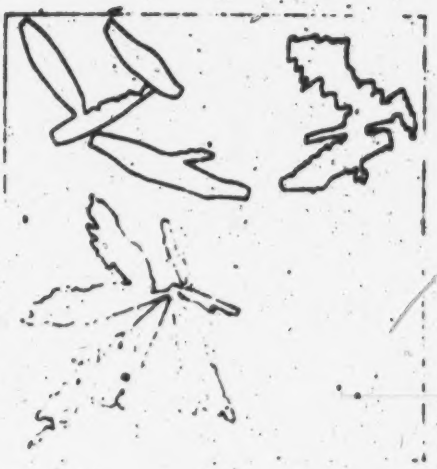
173. How are completed electric lamps (glass bulbs) best {frosted / matted} ?

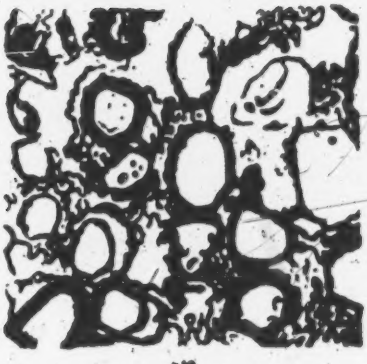
First answer: The {frosting / matting} of glass bulbs which are already complete and mounted is best carried out by dipping in a {frosting / matt etching} bath. The procedure is carried out in the manner that the bulbs, wiped clean with a duster, are first dipped for a short time in hot 5 per cent. fluoric acid and moved to and fro in it and then placed in the {frosting / matt etching} bath until the glass surface is sufficiently {frosted / matt}. For this purpose a solution in 10 litres water of 1 kg. potassium fluoride, 1 kg. ammonium fluoride and ½ litre of high percentage fluoric acid is employed. After etching the bulbs are to be washed in water containing 5 per cent. of hydrochloric acid. Wooden vessels lined with lead are employed for the etching baths.

Second answer:

. . . . . .

Third answer: Glass bulbs for electric lamps can be {frosted / matted}, either by means of the sand blast or in the {frosting / matt} bath. For {frosting / matting} with sand either special machines capable of high output particularly suitable for bulbs are constructed which naturally only come in question where large quantities are to be {matted / frosted}. If however small quantities only are to be {frosted / matted} the {frosting / matt} bath is employed. This consists of potassium fluoride and fluoric acid dissolved in water. The bulbs are first of all thoroughly cleansed and this is best done by placing them in quite weak fluoric acid. After washing, the bulbs come in to the {frosting / matt} bath in which they remain ¼—½ of an hour according to the desired shade. After {frosting / matting} the bulbs are washed with hot water to which a little acetic acid is added whereby the coating produced in the {frosting / matt} bath is better dissolved

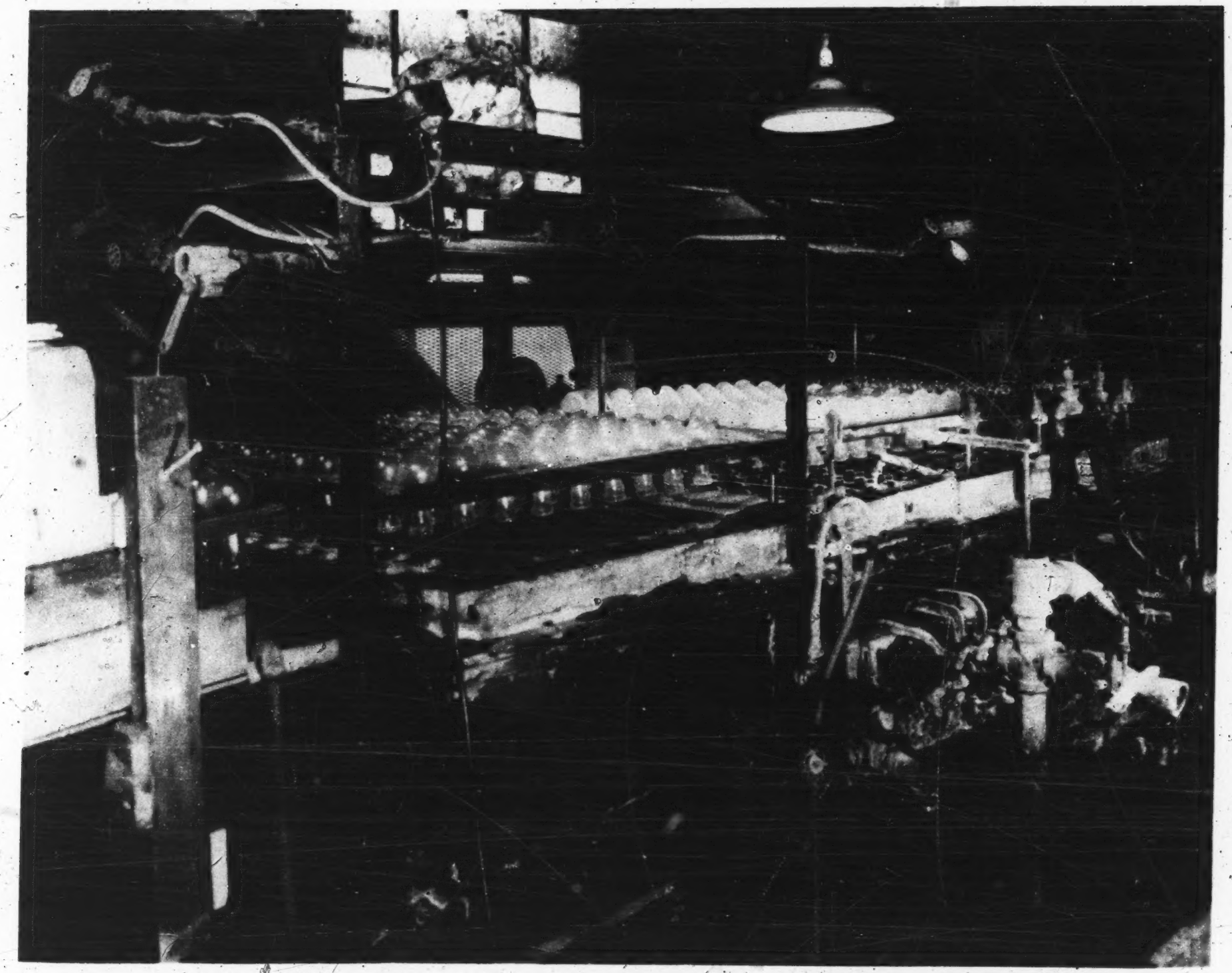


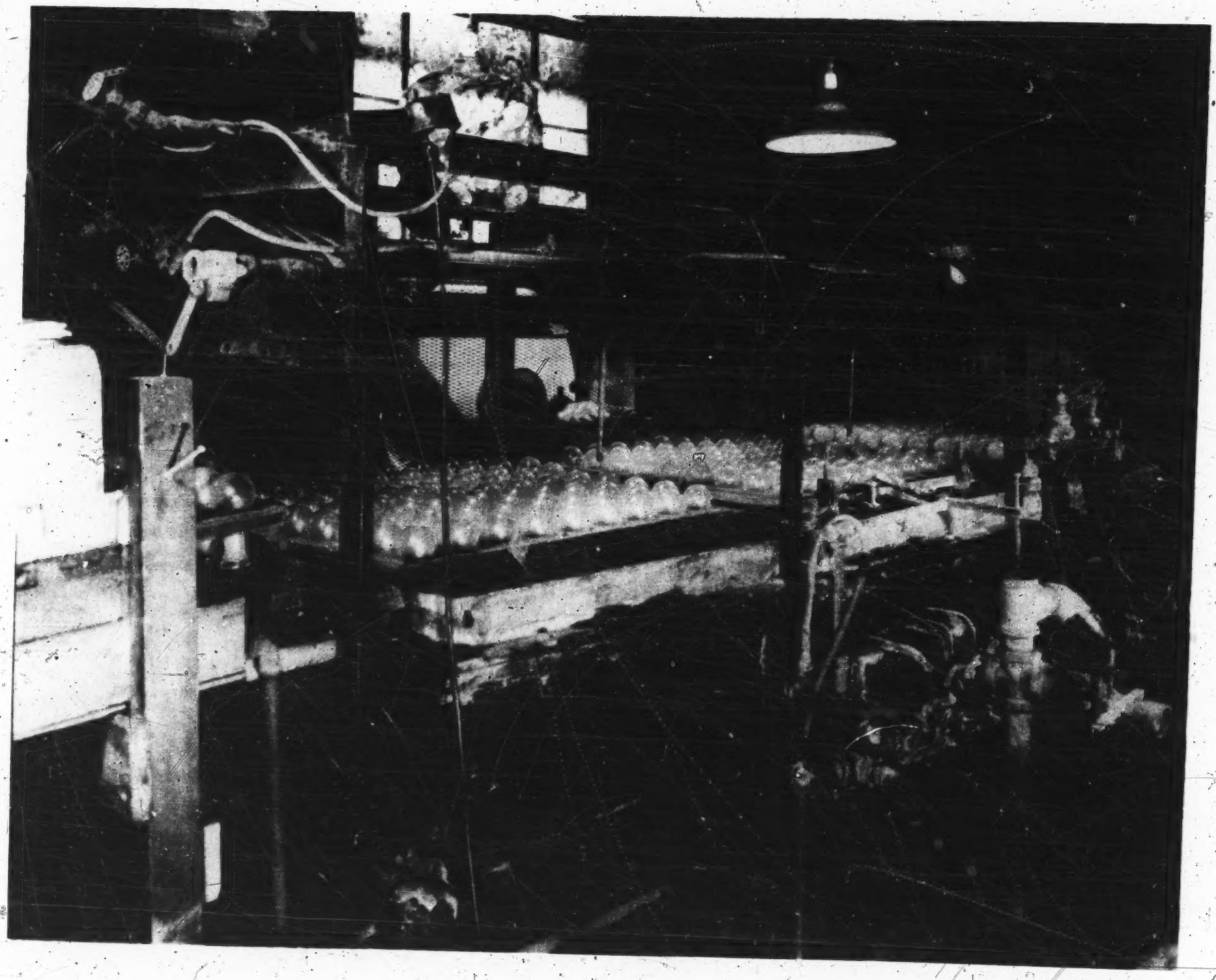


DEFENDANT'S EXHIBIT D-4.

Minutes of the Trial in Contempt Proceedings in General Electric Company v. Wabash Appliances Co., Before Judge Galston.

(Physical Exhibit.)





DEFENDANT'S EXHIBIT D-7.

Patented Dec. 24, 1935 2,025,588

UNITED STATES PATENT OFFICE

2,025,588

ELECTRIC LAMP BULB

Gustav Herzberg, Newark, and William Ambrunn, Harrison, N. J., assignors to General Importing Company, East Newark, N. J., a corporation of New Jersey

No Drawing. Application August 2, 1933, Serial No. 683,290

7 Claims. (Cl. 41—42)

Our present invention relates to the art of frosting the inside surfaces of electric lamp bulbs or other thin walled hollow glass articles, and has for an object a frosting treatment of this description which is simple, economical and effective.

For a great many years past electric lamp bulbs have been frosted on the inside, usually by etching the inside surface of the bulb with hydrofluoric acid, compounds thereof or mixtures adapted by combination to produce hydrofluoric acid.

It is well known, of course, that hydrofluoric acid is well adapted to etch glass; nevertheless, this acid is such an active fluid and acts so rapidly and uniformly over the surface of the glass that it is difficult, if not impossible, to produce a frosting etch by this means, probably for the reason that the action of hydrofluoric acid is so uniform and rapid that it leaves a surface almost as regular and smooth and transparent as the original surface.

It has, therefore, been proposed to use for an etching material instead of hydrofluoric acid as such, mixtures of various materials which produce in their reaction a small percentage of hydrofluoric acid and which possess in addition inert materials which more or less inhibit the too rapid action of the hydrofluoric acid and modify its effect. As a consequence of the irregular action caused by the inhibiting materials, the result has been that instead of the even etch of a pure hydrofluoric acid solution which will not give a frosting etch by means of such mixtures, a frosting etch is produced but the inside surface of the bulb is etched in such a manner that it is full of sharp angular crevices which weaken the glass to such an extent that breakage occurs on very slight shocks. It has been proposed to remedy this and to treat the interior of the bulb a second time with a weaker solution of the same etching fluid. This is called a "fortifying" treatment and is supposed to round out the angular crevices in the glass so that the bulb is much strengthened. Far from doing this, however, the second so-called fortifying treatment merely accentuates and increases the number of angular crevices in the surface of the glass.

The present invention provides a process of frosting the inside surfaces of lamp bulbs and similar articles in such a manner that the light transmitted from the lighting body through the bulb is greatly increased and that undue weakening of the glass of the bulb is avoided. As above stated, if hydrofluoric acid alone were used, the bulb would not be unduly weakened but the action of this acid would be so uniform and regular that the etch would not be a frosting etch. The present invention may be carried out, indeed, by means of various etching fluids but no second or fortifying treatment is necessary. The invention may be described as consisting of a treatment of the interior surface of the glass bulb with a 10% solution of hydrofluoric acid mixed with soda ash, an inhibiting material, and water. This is followed by a treatment applying heat and moisture. The second treatment may consist of spraying into the bulb water suitably heated, or steam.

For a lime glass the following frosting mixture has been found very successful:

	Per cent
Hydrofluoric acid, 10% solution	33
Ammonium bifluoride	25
Ammonium bicarbonate	12
Soda ash	15
Water	15

In this mixture the soda ash and the ammonium compounds, particularly the ammonium carbonate, have the effect of inhibiting the action of the hydrofluoric acid and of producing a finely grained surface. This frosting mixture is heated to about 130° F. and is sprayed into the interior of the bulb intermittently for a period of approximately five seconds. In this time about three sprays of the mixture produce good results. When this treatment is finished, hot water may then be sprayed in also in about three sprays, intermittently applied, within a similar period of time. The temperature of the water should be, for good results, about 180° F. although a considerable range of temperature is permissible. The temperature should not be much less than 150° F. as in such case the glass will not be uniformly affected and may be very ununiform and very weak. After the treatment with hot water as described, cold water is sprayed into the interior of the bulb continuously for about five seconds.

Instead of hot water, steam may be employed, with effects similar to that obtained by the use of hot water.

It will be evident, of course, that the second treatment does not act to any appreciable extent in diminution of the action of the etching mixture by diluting the mixture, but its value and effect is to be ascribed mainly to the effects of heat upon the residue of the etching mixture, making it more active.

It will thus be seen that the process of this invention comprises a single treatment with an

etching mixture suitably heated, a following treatment with water suitably heated, or steam, and a final treatment with cold water. To realize the best results of the process, all three of these steps are necessary.

As it is the method of the present invention to frost the inside of the bulb without unduly weakening the glass, rather than to weaken the glass first and to "fortify" it later, the temperatures to be observed are of considerable importance. We have discovered that if the frosting process is carried out in the cold, a considerable crystallization is likely to take place in the mixture and the resulting frost is likely to be streaky and uneven and the bulb to be very weak. The same is true, also, if the premises in which the process is conducted be very cold. Hydrofluoric acid, consequently, particularly when mixed with the inhibitors of the frosting mixture, is neither very active nor very uniformly active under cold conditions. In fact, we have found that the frosting mixture should be applied at a temperature of about 130° F. or higher and that if the water applied in the second step of the process is much below 150° F., the bulb will be weak and easily broken. In fact, we prefer to heat the water used in this treatment to about 180° F. or even considerably higher. Steam, for instance, may be employed with excellent results, which necessarily implies a much higher temperature.

There is, however, an upper limit beyond which the temperature of the water or steam in the second step should not be raised. This depends upon the strength of the frosting mixture and while no definite temperature can be stated from the nature of the case, it can be easily determined by the fact that at these undesirably high temperatures the action of the mixture produces effects approximating that of hydrofluoric acid alone. In other words, the result is not then a frosting etch but is an almost smooth, transparent etching of the inside of the bulb.

The process, in fact, depends for its efficiency upon the effect of heat in activating the hydrofluoric acid in the frosting mixture and in the presence in this mixture of a quantity of inert or inhibiting material so correlated with the hydrofluoric acid and the temperatures employed that the etch is not only a frosting etch but a very finely and uniformly grained frosting etch on the interior of the bulb and, furthermore, the finished interiorly frosted bulb is of a satisfactory commercial strength.

The third or cold water treatment is not a mere cleansing of the interior of the bulb. This will be evident from the fact that when the second or hot water (or steam) treatment is completed, there is a small but appreciable quantity of the more active elements of the frosting mixture, which under the temperature conditions existing will continue to act upon the glass before sufficient cooling has taken place to inhibit this action. The result is that the bulb is weakened from this continued action upon the glass to a point where it becomes unusable. Moreover, upon cooling, the various constituents of the frosting mixture, or, also, the constituents of the glass, such as silica and lime, or both the constituents of the mixture and the glass in combination, crystallize on the interior of the bulb and give it an unpleasant, unevenly crinkled appearance which renders it uncommercial for that reason alone.

If, however, the third step is quickly applied, that is the cold water treatment immediately following the hot water or steam treatment, the continued action of the frosting mixture is arrested before it has weakened the glass unduly. The formation of crystals or other deposits is also prevented.

It will be observed that the process comprises four important features, viz: a frosting mixture of suitable strength and of suitable temperature, heat applied immediately thereafter in a suitable vehicle such as water or steam, a cooling and inhibiting treatment generally with cold water, and a time element which for excellent results may be about five seconds for each step.

It is well understood in the art that an outside frosting of a lamp bulb results in a diminution of efficiency of about 20%. It is also well understood that in the case of a clear bulb incandescent lamp, when its efficiency falls off 20% it is more economical to destroy the lamp and obtain a new one. Indeed, when a clear bulb lamp has diminished, through use, in efficiency by 20% from its initial efficiency, it is said to have reached the "smashing point" and should be destroyed.

In the lamps of the present invention, however, there is so little light absorption by the interior frosting of the bulb that the initial efficiency is almost equivalent to that of a clear bulb lamp, the difference being only about 3% to 4%. The operating temperature of the lamp is thus much less than that of an outside frosted bulb and this results in a longer life.

What we claim is:

1. The process of applying a light-diffusing frosting to electric lamp bulbs consisting of intermittently contacting the inner surface of the same during an interval of the order of five seconds with a heated frosting mixture, and after such contact intermittently applying combined heat and moisture to said surface during a similar interval, and then treating the same continuously with cold water for approximately the same interval of time.

2. The process of applying a light-diffusing frosting to electric lamp bulbs consisting of contacting the inner surface of the same during an interval of the order of five seconds with a heated frosting mixture, and then subjecting such surface to the action of heat and moisture only during a similar interval, and then treating the same with cold water for approximately the same interval of time.

3. The process of applying a light-diffusing frosting to electric lamp bulbs consisting of contacting the inner surface of the same during a short interval with a heated frosting mixture, and after such contact subjecting such surface to the action of heat and moisture only during a similar interval, and then treating the same with cold water for approximately the same interval of time.

4. The process of applying a light-diffusing frosting to thin-walled hollow glass bodies consisting of contacting against the inner surface of the same a heated frosting mixture, and after such contact applying only heat and moisture to said surface, and then treating the same with cold water.

5. The process of applying a light-diffusing frosting to thin-walled hollow glass bodies consisting of contacting against the inner surface of the same a heated mixture containing hydrofluoric acid and acid salts, applying heat and moisture to said surface, and then treating the same with cold water.

6. The process of applying a light-diffusing frosting to thin-walled hollow glass bodies consisting of contacting against the inner surface of the same a heated mixture containing hydrofluoric acid and acid salts, conveying heat through an aqueous medium to the surface after such contact, and subsequently treating the same with cold water.

7. The process of frosting thin-walled hollow glass bodies consisting of contacting the inner surface thereof with a frosting mixture, then applying a moist heat to said surface, and subsequently treating the same with cold water.

GUSTAV HERZBERG.
WILLIAM AMBRUNN.

DEFENDANT'S EXHIBIT D-8.

"Jewel" Frosted Lamp Made in Demonstration No. 1, by Herzberg.

(Physical Exhibit.)

DEFENDANT'S EXHIBIT D-9.

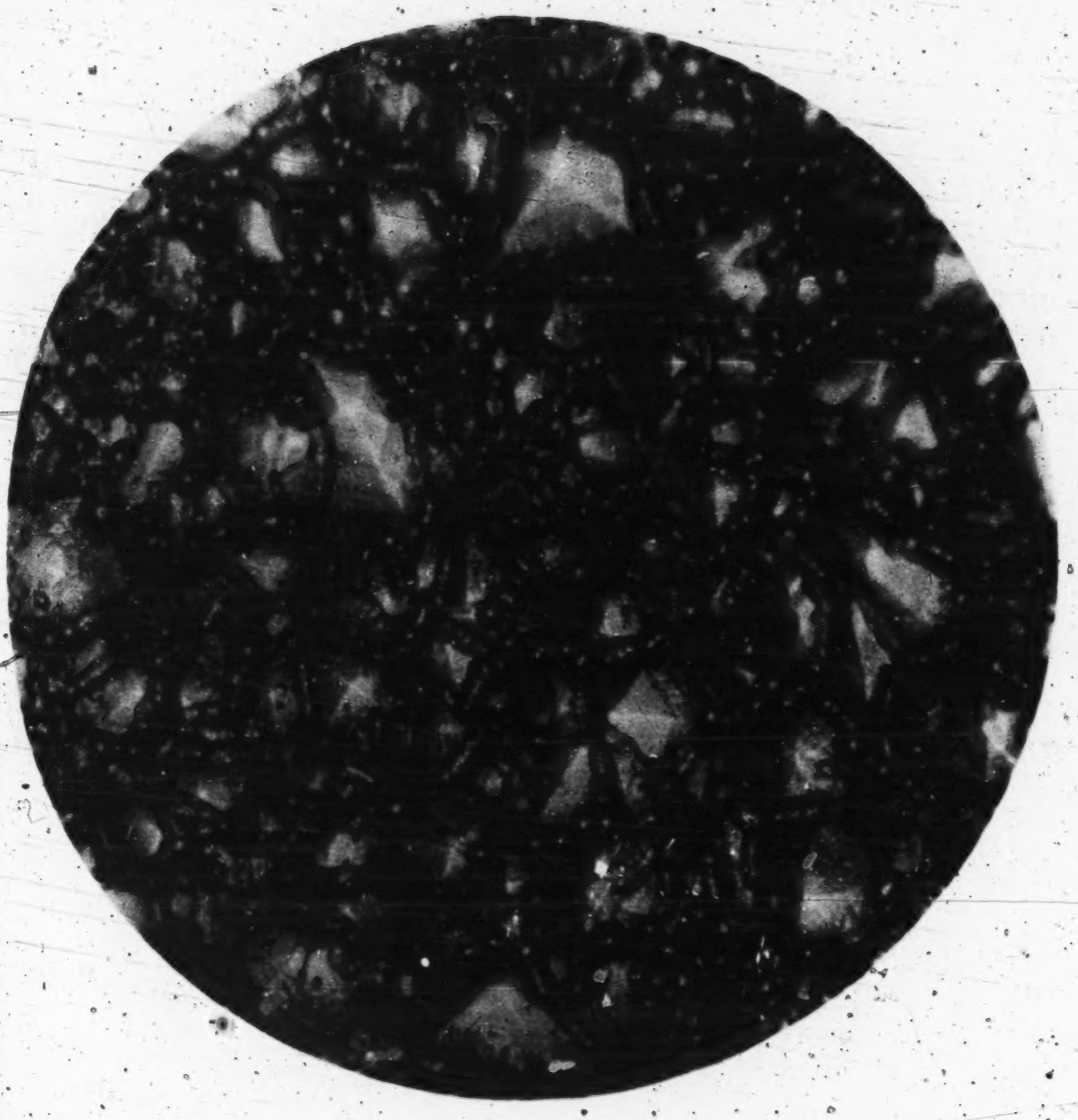
"Jewel" Frosted Lamp Made in Demonstration No. 2, by Herzberg.

(Physical Exhibit.)

DEFENDANT'S EXHIBIT D-10.

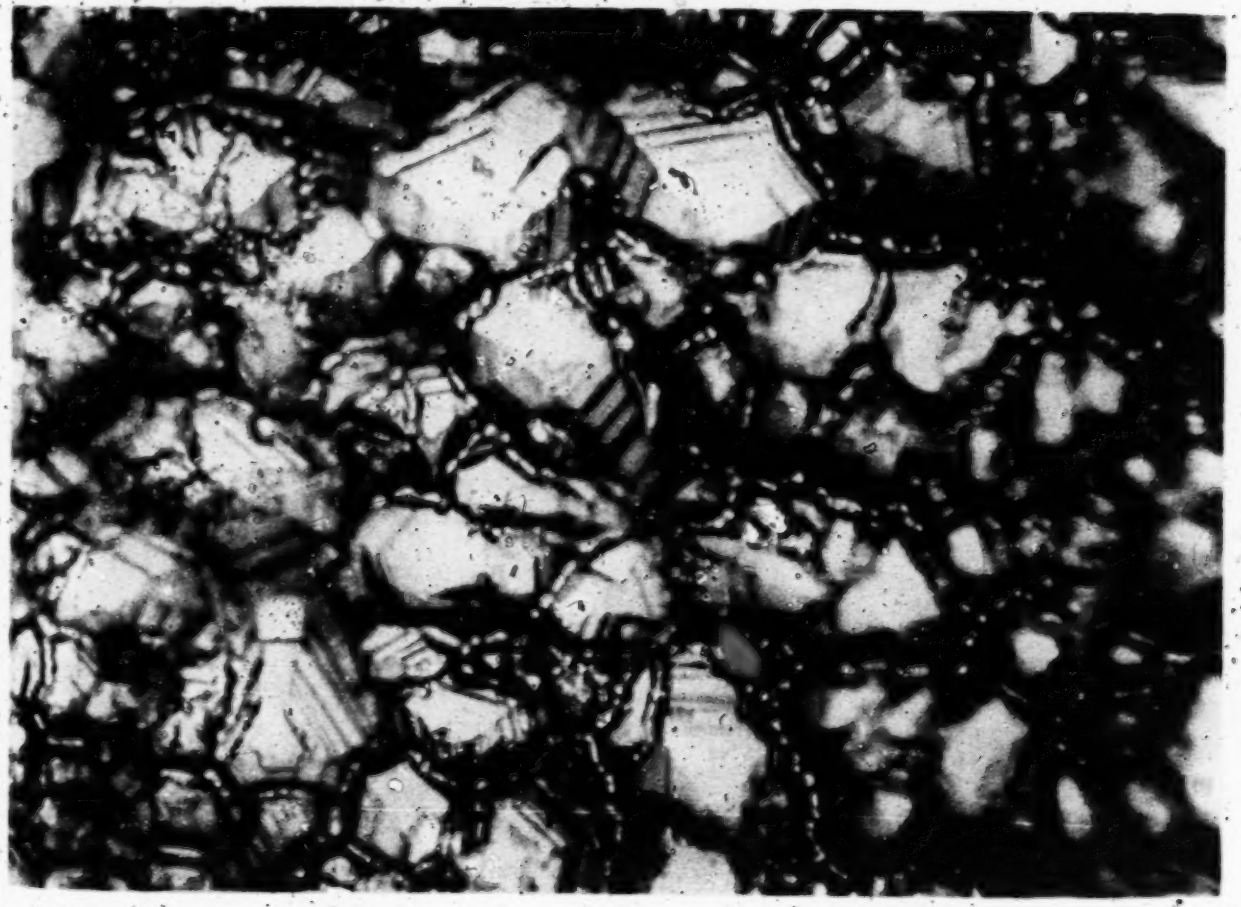
"Jewel" Frosted Lamp Made in Demonstration No. 3, by Herzberg.

(Physical Exhibit.)



DEFENDANT'S EXHIBIT D-12.

DEFENDANT'S EXHIBIT D-13.



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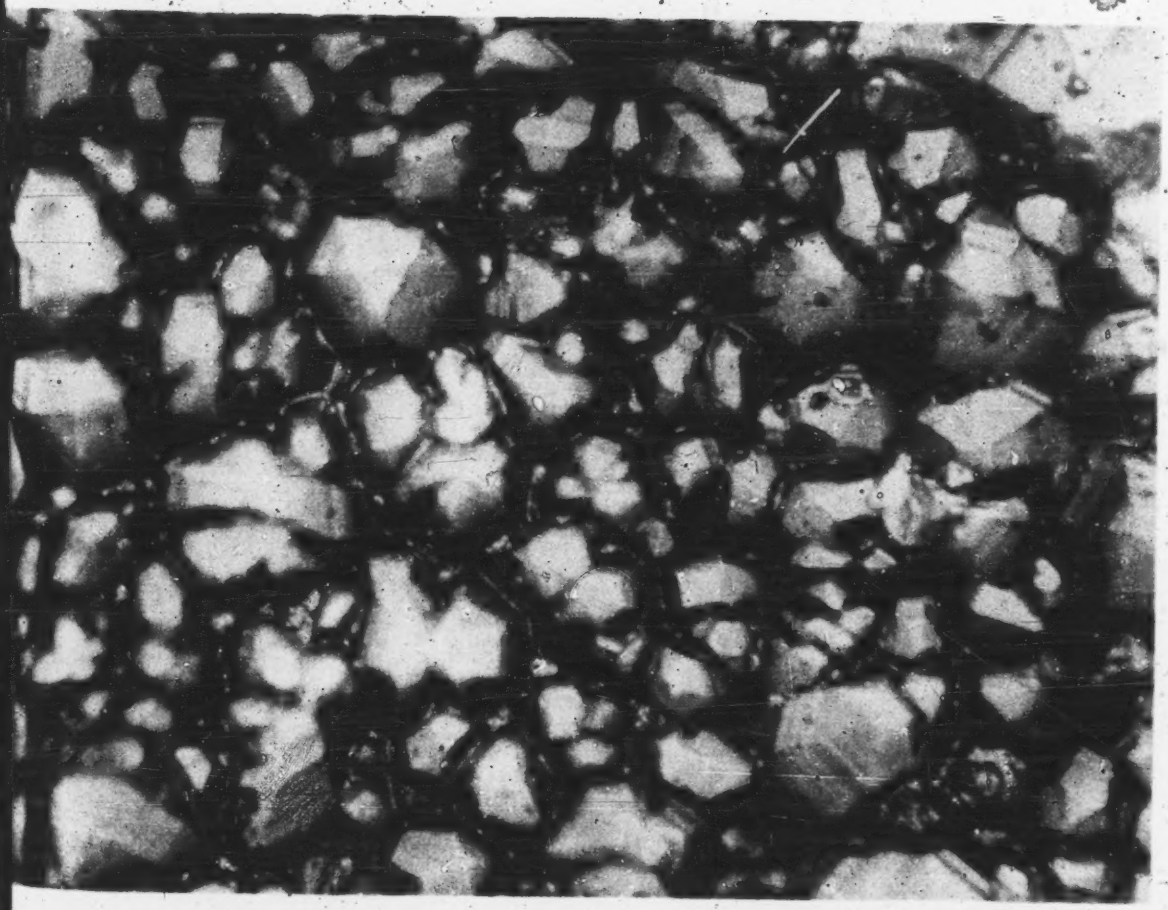

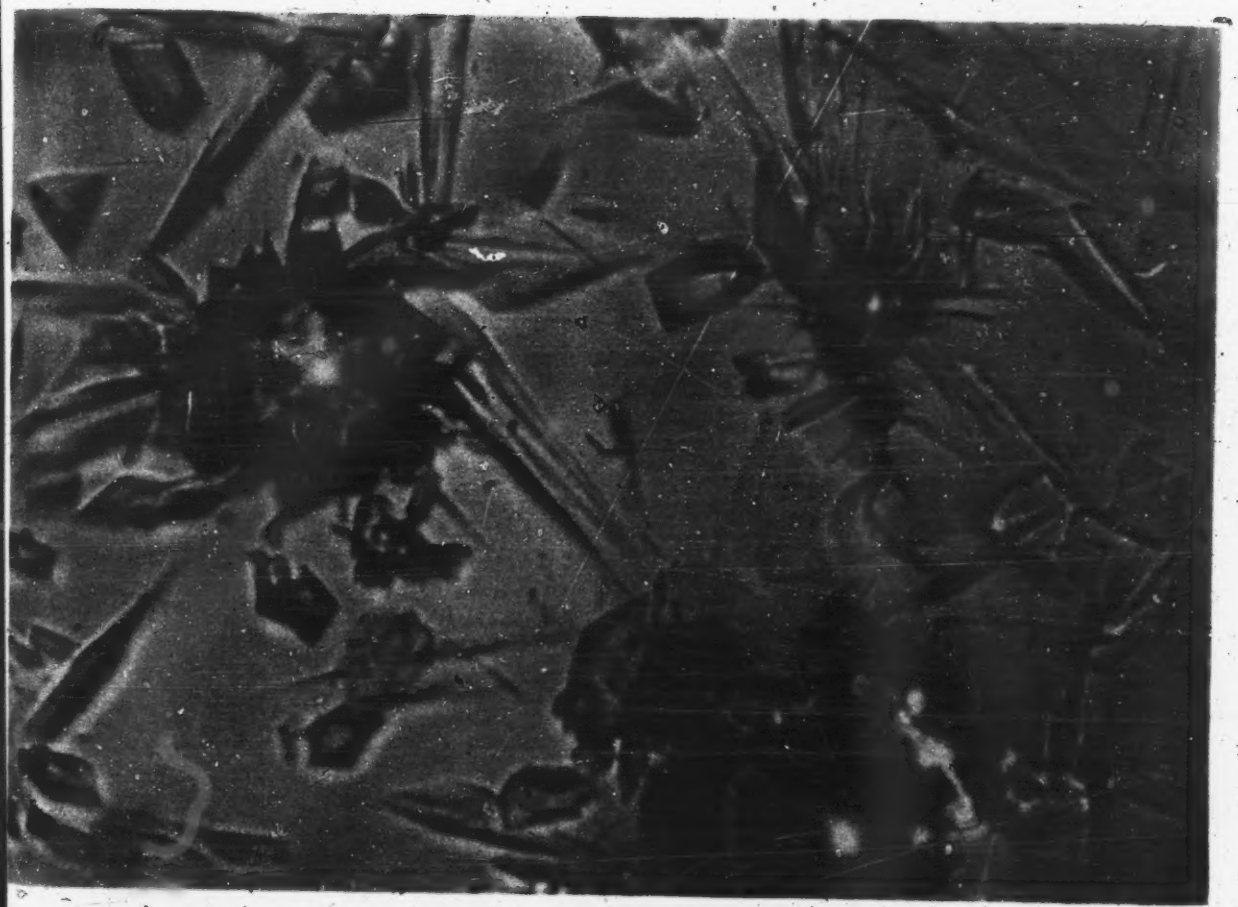

MEMORANDUM OPINION.

Appearances:

HOWSON & HOWSON, ESQS., Attorneys for Plaintiff,
ALEXAMDER C. NEAVE, of Counsel;
KESSLER & KESSLER, ESQS., Attorneys for Defendants,
SAMUEL E. DARBY, JR., ESQ., of Counsel.

SMITH, *District Judge:*

This is a suit for the infringement of Patent No. 1,687,510, issued on the application of Marvin Pipkin, who, prior to the issuance thereof, assigned all right, title and interest therein to the plaintiff. The patent covers an article of manufacture therein identified as an "ELECTRIC LAMP BULB." This suit is directed to a similar article of which the defendant Jewel Incandescent Lamp Company is the manufacturer, and the defendant Nulite Electric Company is the distributor. The defendants deny infringement and challenge the validity of the patent.

The invention of the patent relates to a frosted glass bulb of the type in common use in incandescent lamps, but is directed particularly to an improvement therein, to wit, an interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices." The advantages of the frosted interior, as well as the disadvantages of the frosted exterior, had been generally recognized prior to the present invention and, therefore, do not require recitation here; but, it had also been recognized that the frosted interior, although otherwise advantageous, impaired the strength of the bulb. The primary object of the invention was to overcome this defect without destroying the diffusive qualities of the mat surface. The improvement accomplished this desired result.

The determination of the ultimate issues requires a determination of the scope of the allowed claims, which, in the opinion of the Court, is narrow. The invention is defined in claim 1, which is typical, as follows: "*A glass*

electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent. of that of said lamp with a clear bulb, *said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices* to such an extent that the strength to resist breakage by impact is greater than twenty per cent. of that of a clear bulb." When the allowed claims are read and interpreted in the light of the rejected claims and the prior art, both of which are hereinafter discussed, it is evident that the invention of the patent, measured by the claims, is restricted to a glass bulb possessing an interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices." There is no other feature, except those which are exclusively functional, to which the patentee lays claim.

It is conceded that the described improvement, to wit, the interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices," is the unavoidable result of a chemical etching process which had been in common use in the glass industry for many years prior to the present invention. This result, like many chemical phenomena, is so inherent in the process that it is difficult, if not impossible, to alienate the defined surface from the process which produces it. The claims of the patent in suit, as well as the disclosures of the prior art references, must be read in the light of this fact if their full import is to be appreciated.

The claims in suit, although directed to an improvement in an article of manufacture, to wit, the interior mat surface, are so drafted as to necessarily embrace the chemical process by which the defined result is produced. The process and the result are so inter-related that they are inseparable. It follows that the claims, although they appear to be directed to a structure, are anticipated by earlier disclosures of the process incorporated into them either by

implication or otherwise. *Red River Refining Co. v. Sun Oil Co.*, 29 F. Sup. 636, Aff'd. 112 F. (2d) 575. The language of Judge Kirkpatrick in the cited case is particularly applicable here. It is therein stated, at page 641, that: "Many descriptive terms used in product claims necessarily imply a reference to processes, and thus it sometimes occurs that what appears to be a product claim is in reality for a process. While these claims may be dealt with as general product claims, disclosures of prior processes which anticipate the process incorporated into them and which will produce identical products, necessarily anticipate even though they do not specifically describe or claim the products." There is in each of the claims in suit an explicit reference to the etching process as the only means by which the result may be produced. The purported invention is not, as the plaintiff contends, an article of manufacture "however produced", but an improvement therein resulting only from the application of the identified process, and no other. Cf. *Smith v. Goodyear Dental Vulcanite Co.*, 93 U. S. 486, 493.

It clearly appears from the prior art publications that long before the present invention extensive studies had been made of the chemical etching process which had been in common use in the glass industry. The results of these studies had been widely published, and there was available to Pipkin, at the time of his invention, a fund of pertinent knowledge. It had been discovered and published that the primary treatment of glass with etching solutions of well known formulae produced a mat surface characterized by the presence of microscopic hexagonal or octagonal depressions and acute angular interstices. It had also been discovered and published that the secondary treatment of such a mat surface with dilute hydrofluoric acid reduced the acute angles and produced concave interstices, thereby imparting a smooth finish. The process of multiple etching, recommended by Pipkin in his specifications, as well as the results of its application, defined by Pipkin in his claims, had been studied and publicly revealed as early as 1887, if

not earlier. These conclusions are amply supported by the relevant prior art publications [1] relied upon by the defendant. Those which are apposite are worthy of special consideration.

REINITZER, CONTRIBUTIONS TO THE KNOWLEDGE OF GLASS ETCHING, Die Glashutte, published in 1887, presents such an exhaustive study of the subject matter that it is difficult to select any part of the text as particularly applicable without detracting from the full significance of its disclosures. This is equally true of TILLOTSON, ON THE RELATION BETWEEN THE PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF GLASS ETCH FIGURES, The Journal of Industrial and Engineering Chemistry, published in 1917. These papers disclose the multiple etching process recommended by Pipkin in his specifications and describe, in language almost identical with that of his claims, the mat surface claimed by him as the essential feature of his invention, the unavoidable result of the process. It seems evident, if these disclosures are accorded their comprehensive significance, that there is no patentable feature which distinguishes the mat surface defined by Pipkin from that described by both Reinitzer and Tillotson.

It is particularly significant that Reinitzer, in 1887, and Tillotson, in 1917, not only revealed that the multiple etching process imparted to the glass a smooth mat surface, but recognized that such a surface possessed definite diffusive qualities of utility, a functional characteristic embodied in each of the claims in suit. It is of further significance that each of them taught that the physical characteristics of the mat surface, and consequently the diffusive qualities inherent therein, were dependent upon and controllable in the successive steps in the process.

[1] Reinitzer, Contributions to the Knowledge of Glass Etching, Die Glashutte, published in 1887; Tillotson, On the Relation Between the Physical Properties and Chemical Composition of Glass Etch Figures, The Journal of Industrial and Engineering Chemistry, published in 1917; The Etching of Hollow Glass, Sprechsaal, No. 49, published in 1907; Sprechsaal, Nos. 21 and 22, published in 1906; Present Day Manufacture Working Up an Ornamentation of Finer Hollow Glass (Hohlbaum, 1910); Sprechsaal, No. 46.

There are but three of the prior art patents relied upon by the defendants which are particularly relevant: The KENNEDY Patent (No. 733,972), the WOOD Patent (No. 1,240,398) and the CORRELL Patent (British—No. 166,133). The WEBB Patent (No. 122,696) and the ARCHER Patent (No. 152,059) are relevant only because of their disclosure that the etching of the interior surface of hollow glassware had been practiced as early as 1871. The HARRISON Patent (No. 1,299,936) is irrelevant because its disclosures are too remote.

The patent to KENNEDY, granted on July 21, 1903, was directed to a method of frosting the interior of a glass bulb of the type then in common use in incandescent lamps. The object of the invention, in the language of the inventor, was "to produce on the inner surface of the bulb a frosted appearance, which may cover the whole of the said inner surface or only a part thereof." The patent instructed that the inner surface of the bulb be treated with an etching solution and thereafter rinsed with water. The instructions, although they did not specifically contemplate the multiple etching process, did not preclude its application. The glass technologist, desirous of imparting to the interior of a bulb the mat surface hereinabove described, could, following the method of Kennedy, avail himself of the multiple etching process then in common use. This practice of the method would produce, as the unavoidable result of the multiple etching process, the mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices," to which Pipkin asserts claim. Any other construction, and especially the one here urged by the plaintiff, would deny the Kennedy patent the full import of its disclosures.

It is unnecessary, however, to amplify the disclosures of Kennedy by incorporating therein the earlier teachings of others. It was convincingly demonstrated at the trial of this cause that a bulb frosted according to the method of Kennedy was comparable in strength to the bulb defined

by Pipkin in his claims. It is apparent, unless the earlier teachings are totally disregarded, if the method as demonstrated is followed, that the mat surface of the respective bulbs are identical, whether frosted according to the teachings of Kennedy or the recommendations of Pipkin. If the method of Kennedy is followed, as it was in the demonstration, the unavoidable result is the bulb defined by Pipkin in his claims. The success of the demonstration must be attributed to the use of hot water in the rinsing operation. It seems obvious that the rinsing, as thus carried out, is equivalent to washing with a hot solution of dilute hydrofluoric acid; the etching solution remaining on the etched surface becomes the active ingredient of the rinse.

The plaintiff, in an effort to avoid anticipation, argues that the demonstration was a departure from the method of Kennedy in that the rinsing of the mat surface was carried out in hot water and not in cold water. It must be conceded that Kennedy made no recommendation as to the temperature of the rinsing water, but it appears from the prior art publications that rinsing with hot water, rather than cold water, had been common practice. Reinitzer, at page 74, acknowledged, without asserting any claim to originality, the importance of temperature to the etching process, especially where a smooth finish was desired. The art under discussion is so akin to the field of chemistry that it is inconceivable that glass technologists, prior to Kennedy, had not recognized the influence of temperature in the etching process.

The patent to Wood, granted Sept. 18, 1917, was directed to a "Method of Making Light Diffusing Screens", and defines the invention in claim 2 thereof, which is typical, as follows: "The method of making a light diffusing screen, which consists in forming in a glass surface by mechanical abrasion a multiplicity of irregular pits separated by a plain surface relatively wide as compared with the depth of the pits, *and then smoothing it and enlarging these pits into contiguous concave depressions by the application of*

acid to the pitted surface of said glass, and then removing the acid therefrom, each of said depressions forming the surface of a concave lens." This patent, although directed to a method, describes in detail a smooth mat surface, equivalent to that defined by Pipkin, resulting from its application. There is no critical distinction, unless the descriptive language used can be so regarded, between this disclosure and that of the claims in suit. The difference in the means employed, either chemical or mechanical, in producing the initial etch, is not a critical difference, and no point is here made of it.

It is apparent from the specifications of the patent to Wood, that he, as had the others who preceded him, recognized that the smooth mat surface possessed diffusive qualities of utility. This he expressed in this language: "These microscopic lenses, which cover the surface, diffuse the light in a very perfect manner and transmit practically all of light, the loss due to reflection from the steep sides of irregularly formed pits being absent in this case." It should be noted that this was an additional object which Pipkin hoped to accomplished by his invention, and, it may be assumed that in this regard he realized better result. It cannot be disputed, however, that Wood was fully appreciative of the diffusive qualities inherent in the physical characteristics of the structure.

The real significance of the Wood patent lies in the fact that the patentee not only defined the smooth mat surface, as well as the method of creating it, but clearly suggested its use in the bulbs of incandescent lamps. This suggestion, embodied in the specifications, follows: "Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing a very marked loss in the efficiency of the lamp, which results from frosting the bulbs in the usual manner." This disclosure, which the plaintiff urges is a casual statement of no importance, must be read in the light of the admitted facts that the advantages of frosting the interior of glass bulbs had been

theretofore recognized and the method had been theretofore taught. The properties inherent in the mat surface defined by Pipkin are likewise, and for the same reason, inherent in the mat surface described by Wood. The fact that Wood may not have appreciated all of them does not minimize the effect of the disclosure.

The patent to CORRELL, granted September 7, 1922, was directed to an improvement in "screens" used for the "reception of optically-projected images, pictures," etc. It is evident from the specifications that the inventor availed himself of the multiple etching process, hereinabove discussed, to impart to a glass screen a "satin finish" of desired diffusive quality. The specifications instructed that the surface "is produced by first heavily matteing with 'white acid', sandblasting or equivalent and *subsequently reducing or clearing such surface with hydrofluoric acid.*" The apparent object of the secondary treatment was to reduce the sharp angular crevices and thereby produce the "satin finish", an essential element of the invention. The mat surface, the unavoidable result of the multiple etching process recommended in the specifications, is identical with that defined in the claims in suit, although otherwise described.

It is obvious that there was nothing new in either the interior mat surface defined by Pipkin in his claim, or the process identified therein as the method of producing it. The advance over the prior art, if any, was in reality nothing more than the application of the multiple etching process to another article of hollow glassware, the bulb of an incandescent lamp, a course plainly indicated by the teachings of the prior art. It is well established that the adaptation of an old process to a new use, clearly indicated by the prior art, is not invention. *Paramount Publix Corp. v. American Tri-Ergon Corp.*, 294 U. S. 464; *Lovell Mfg. Co. v. Cary*, 147 U. S. 623; *Brown, et al. v. Piper*, 91 U. S. 37; *Floridin Co. v. Attalpulgus Clay Co.*, 125 F. (2d) 669; *Goodman, et al. v. Paul E. Hawkinson Co.*, 120 F. (2d) 167;

Dorr Co. Inc. et al. v. Yabucoa Sugar Co., 119 F. (2d) 521; *Globe Oil & Refining Co. v. Sinclair Refining Co.*, 103 F. (2d) 95; *U. S. Rubber Co. v. Sidney Blumenthal & Co.*, 98 F. (2d) 767; *Celite Corp. v. Dicolite Co.*, 96 F. (2d) 242, and other cases herein cited. The discovery that the multiple etching process possessed an unsuspected advantage and accomplished an unexpected result, without any exercise of the inventive faculty, was not a patentable discovery. *Lovell Mfg. Co. v. Cary; Floridin Co. v. Attapulgus Clay Co.; Red River Refining Co. v. Sun Oil Co.*; all *supra*, and other cases herein cited. The incorporation of the mat surface into an article of hollow glassware, a use likewise plainly indicated by the prior art, was not invention; this, as in the case of the process, was nothing more than the adaptation of an old structure to a new use. *St. German v. Brunswick*, 135 U. S. 227; *Heald v. Rice*, 104 U. S. 737; *Perfect Circle Co. v. Hastings Mfg. Co.*, 88 F. (2d) 813; *Grand Rapids Refrigerator Co. v. Stephens*, 27 F. (2d) 243; *Novocol Chemical Mfg. Co. v. Powers & Anderson Dental Co.*, 128 F. (2d) 904, and other cases cited in the succeeding paragraph.

The claim to invention here rests upon the fact, fully accepted by the parties, that no one prior to Pipkin had perceived that the interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices" increased the resistance of a frosted glass bulb to breakage. This fact neither enhances the claim to invention nor impairs the disclosures of the prior art. The discovery of this peculiar property, inherent in the physical characteristics of the mat surface, was not a patentable "discovery" within the meaning of the statute; *In re Lewis*, 108 F. (2d) 248; *In re Hoover*, 102 F. (2d) 849; *In re Newton, et al.*, 96 F. (2d) 291; *In re Heap*, 74 F. (2d) 948; *General Electric Co. v. DeForest Radio Co., et al.*, 28 F. (2d) 641; and, the adaptation of the mat surface to a new use to which it was readily adaptable by reason of this peculiar property, was not a patentable "invention" within the meaning of the statute. *Ausonia Brass Co. v. Electrical*

Supply Co., 144 U. S. 11; *Bingham Pump Co. v. Edwards*, 118 F. (2d) 338; *Krupp Nirosta Co. et al. v. Coe*, 96 F. (2d) 1013; *Goldman v. Polan, et al.*, 93 F. (2d) 797. That those who preceded Pipkin neither appreciated all of the properties inherent in the structure, nor perceived all the uses to which the structure was accommodable, does not minimize the effect of their disclosures. *Corona Tire Co. v. Dovan Chemical Corp.*, 276 U. S. 358; *Roberts v. Ryer*, 91 U. S. 150; *Lovell Mfg. Co. v. Cary, Stow v. Chicago*, both *supra*; *E. Edelmann & Co. v. Auto Parts Co.*, 127 F. (2d) 897; *Patents, Inc. v. Gillette Safety Razor Co.*, 115 F. (2d) 484; *Nichols v. Minnesota Mining Co.*, 109 F. (2d) 162; *Enterprize Mfg. Co. v. Shakespeare Co., et al.*, 106 F. (2d) 800; *Floridin Co. v. Attapulgus Clay Co.*; *Goodman, et al. v. Paul E. Hawkinson Co.*, *Bingham Pump Co. v. Edwards*, all *supra*. See *Radio Corporation of America, et al. v. Radio Engineering Laboratories, Inc.*, 293 U. S. 1, 14.

The facts in the case of *Ansonia Brass Co. v. Electrical Supply Co.*, *supra*, seem to be strikingly similar to those of the instant case. In that case, as here, the patent, which covered an insulator, was directed to a peculiar property of the structure, incombustibility, which theretofore had not been recognized. The Court, at page 17, comparing the patent there in suit with a patent of the prior art, stated, "It is true that the insulator used by Holmes was not intended to be, and perhaps was not known to be, incombustible, since this feature of its incombustibility added nothing to its value for protecting a burglar-alarm wire, which carries a current of comparatively low tension; but, as already observed, the testimony indicates that the insulator employed by him was in fact nearly, if not quite, as incombustible as that made by the plaintiff under the Cowles patent. If this be so, and the two insulators are practically the same in their method of construction, it is clear that Cowles *has no right to claim the feature of incombustibility as his invention*, since nothing is better settled in this court than that the application of an old process to a new and

analogous purpose does not involve invention, even if the new result had not before been contemplated." The principle there enunciated is particularly applicable here.

It may be generally conceded that the adaptation of either a process or a structure to a new use in a remote industrial field may rise to the dignity of invention if an original and useful result, not theretofore conceived, is accomplished. The contribution of Pipkin, however, does not meet these standards. The chemical etching process had been in common use in the glass industry for many years and the results of its application had been well known. The glass technologist confronted by the problem, as was Pipkin, and having discovered the cause of the defect, as did Pipkin, had but to draw upon the fund of available knowledge for his remedy. This required nothing more than the expected skill of the art. *Detroit Gasket & Mfg. Co. v. Victor Mfg. & Gasket Co.*, 114 F. (2d) 868. The case of *Gilbert Spruance Co. v. Ellis-Foster Co.*, 114 F. (2d) 771, upon which the plaintiff relies, is easily distinguishable from the instant case. There the inventor demonstrated inventive genius in that "he seized upon a thing which was available to all which had been grasped by none, and was able to fit it into a new place, *to create an original and useful result.*" The alleged invention of Pipkin does not meet the test therein prescribed.

The comment of Justice Bradley in the case of *Atlantic Works v. Brady*, 107 U. S. 192, 199, seems to be particularly pertinent here. It follows:

> "The process of development in manufactures creates a constant demand for new appliances, which the skill of ordinary head-workmen and engineers is generally adequate to devise, and which, indeed, are the natural and proper outgrowth of such development. Each step forward prepares the way for the next, and each is usually taken by spontaneous trials and attempts in a hundred different places. To grant to a single party a monopoly of every slight advance made,

except where the exercise of invention, somewhat above ordinary mechanical or engineering skill, is distinctly shown, is unjust in principle and injurious in its consequences.

"The design of the patent laws is to reward those who make some substantial discovery or invention, which adds to our knowledge and makes a step in advance in the useful arts. Such inventors are worthy of all favor. It was never the object of those laws to grant a monopoly for every trifling device, every shadow of a shade of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures. Such an indiscriminate creation of exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers who make it their business to watch the advancing wave of improvement, and gather its foam in the form of patented monopolies, which enable them to lay a heavy tax upon the industry of the country, without contributing anything to the real advancement of the arts. It embarrasses the honest pursuit of business with fears and apprehensions of concealed liens and unknown liabilities to lawsuits and vexatious accountings for profits made in good faith."

It follows that the claims in suit are invalid because of anticipation by and lack of invention over the prior art.

The patent in suit originated in an application filed in the Patent Office on February 4, 1924. The claims advanced in the said application were directed to both "method" [2] and "manufacture." [3] The said claims were rejected on

[2] The method of treating glass lamp bulbs and similarly thin glass articles which consists in chemically etching a surface thereof and afterwards subjecting the etched surface to the action of a reagent having a solvent action on the material of said surface. (This claim is typical.)

[3] A bulb for electrical lamps and smaller articles having its inner surface covered with rounded etching pits or depressions. (This claim is typical.)

the patent to Wood, hereinabove discussed, and were thereupon cancelled. Thereafter, on August 24, 1925, similar claims, more comprehensive in language, were substituted; these claims were, likewise, rejected on the patent to Wood. It should be noted that the structural elements of the "manufacture" defined in the claims in suit are identical with the structural elements of the "manufacture" defined in each of the rejected claims. A second application, a continuation in part of the original application, was filed on June 29, 1925. The claims advanced in the latter application, and the amendments thereof, were similarly directed to both "method" [4] and "manufacture." [5] The seventeen claims directed to the manufacture, and asserted in the amended application of November 22, 1926, were rejected because of their failure, as stated by the Examiner, "to claim any invention pointing out, as they do, merely the result of the invention." The application was finally amended on April 17, 1928, at which time the claims which had been theretofore advanced were cancelled, and the claims embodied in the patent in suit were asserted. These claims, as hereinbefore stated, were directed to a manufacture.

There are three significant facts apparent from this brief review of the history of the patent: first, claims defining the structural elements of the manufacture were rejected because of anticipation by and lack of invention over the prior art; second, claims defining the functions of the structural elements were properly rejected for the obvious reason that functions, as such, are not patentable; and third,

[4] The method of inside frosting a bulb which consists in first chemically frosting the inside thereof by etching until the bulb has a distinctly whitish appearance and then subjecting the surface thus produced to a chemical etching medium with the conditions of time, temperature and etching strength of the medium such, that the etching effect is less powerful than that of the original frosting treatment. (This claim is typical.)

[5] A glass bulb for electric lamps and similar devices which is inside frosted in such manner that the maximum brightness in candles per square centimeter of an ordinary incandescent lamp comprising such a bulb is less than thirty per cent. of that of the same lamp with a clear glass bulb and the light absorption is less than three per cent. of the light emitted by the light source, said bulb having a strength to resist breakage by impact greater than sixteen per cent. of that of the clear bulb. (This claim is typical.)

the claims in suit, as finally framed, differed from those previously rejected only in their embodiment of both structural elements and functions.

There was nothing which distinguished the mat surface defined by Pipkin from the mat surface described by those who preceded him, except the functions ascribed to it in the particular article of manufacture, to wit, diffusion of light and resistance to breakage. The novelty of the invention, if any, lay, not in the structural elements, but in their function. The critical observation of Justice Reed in the case of *General Electric Co. v. Wabash Appliance Corp. et al.*, 303 U. S. 364, at page 371, is apposite: "But the vice of a functional claim exists not only when a claim is 'wholly' functional, if that is ever true, but also when the inventor is painstaking when he recites what has already been seen, and then uses conveniently functional language at the exact point of novelty." It is well established that the patentability of a claim directed to an article of manufacture must be found in the structural elements therein defined and not in the functions to which claim is asserted. *Holland Furniture Co. v. Perkins Glue Co.*, 277 U. S. 245; *B. B. Chemical Co. v. Cataract Chemical Co.*, 122 F. (2d) 526; *In re Fischer*, 91 F. (2d) 219; *George K. Hale Mfg. Co. v. Hafleigh & Co. et al.*, 52 F. (2d) 714; *Heidbrink, et al. v. McKesson*, 290 Fed. 665; *Walker on Patents, Deller's Edition*, page 795, Sec. 168, *et seq.*

If, as the plaintiff contends, the claims in suit are directed to an article of manufacture, "however produced", their disclosures are insufficient to meet the requirements of the statute, R. S. 4888, 35 U. S. C. A. 33. The statute requires the inventor to define his invention "in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, * * *, to make, construct, compound and use the same;" and, to "particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery." The reasons which underlie the statutory

requirements are succinctly stated in the case of *General Electric Co. v. Wabash Appliance Corp. et al., supra,* at page 369, as follows: 'The limits of a patent must be known for the protection of the patentee, the encouragement of the inventive genius of others and the assurance that the subject of the patent will be dedicated ultimately to the public. The statute seeks to guard against unreasonable advantages to the patentee and disadvantages to others arising from uncertainty as to their rights. The inventor must 'inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.' "

The invention is defined in each of the claims in suit as follows: "A glass electric lamp bulb having its interior surface frosted by etching * * *, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices *to such an extent* that the strength to resist breakage by impact is greater than twenty per cent. of that of a clear bulb." The absence of satisfactory objective criteria is apparent. The claims fail to fix the critical limits with the exactitude required by the statute. The term "extent", used, as it must be, to define measure or degree, is so vague that the critical limits can be determined only upon independent experiment. It follows that the claims in suit are indefinite and, therefore, void. *General Electric Co. v. Wabash Appliance Corp. et al., supra; The Incandescent Lamp Patent*, 159 U. S. 465; *B. B. Chemical Co. v. Cataract Chemical Co., supra; Allen-Bradley Co. v. Eric Resistor Corp.*, 104 F. (2d) 150, and cases therein cited. The pronouncement of the Court in the case of *General Electric Co. v. Wabash Appliance Corp., et al.*, at page 369, when paraphrased, fits the instant case. It was there said: "Patentees may reasonably anticipate that claimed inventions, improvements and discoveries, turning on points so refined as the granular structure of products (here the configuration of a mat surface), require

precise descriptions of the new characteristic for which protection is sought. In a limited field the variant must be clearly defined."

The indefiniteness of the claims in suit is apparent upon attempt to compare the accused structure with their teachings. Satisfactory comparison is impossible because of the lack of a precise definition of the invention. The testimony of Charles Douglas Spencer, a physicist called as a witness on behalf of the plaintiff, would seem to support this conclusion. The witness compared the accused structure, not with the teachings of the patent, but with a structure manufactured by the plaintiff. Such a comparison, however, even though the structures are identical, will not support a charge of infringement. An allegation of infringement can be sustained only by proof of encroachment upon the claims of the patent. *S. S. Kresge Co. v. Davies*, 112 F. (2d) 708; *Magnavox Co. v. Hart & Reno, et al.*, 73 F. (2d) 433; *Grand Rapids Showcase Co. v. Wolverine Showcase Co.*, 38 F. (2d) 730.

It should be observed that the witness experienced little difficulty in making the comparison and in pointing out striking similarities in the compared structures. The reason for the successful comparison, however, was obvious; both structures had been etched by chemical processes which had been in common use long prior to Pipkin. Comparable results were inevitable. It is the conclusion of the Court, based upon careful examination of the photomicrographs received in evidence, that the mat surface of the accused structure, as well as the mat surface of the structure manufactured by the plaintiff, is substantially identical with the mat surface of the prior art. If this is the mat surface defined by Pipkin in his claims, there can be no infringement. *Conolite Corporation v. Davidovicz, et al.*, 111 F. (2d) 121; *Galion Iron Works & Mfg. Co. v. Beckwith Machinery Co.*, 105 F. (2d) 941.

It is difficult here to assume validity for the purpose of passing on the question of infringement. Such an assump-

tion can be predicated only upon the construction hereinbefore adopted by the Court, to wit, that the claims in suit, although directed to an improvement in an article of manufacture, the interior mat surface, are so drafted as to necessarily embrace the method under which the defined result is produced. This strict construction so narrows the claims as to negative infringement. There can be no infringement of the claims, as thus construed, unless the accused structure is produced under the method recommended in the specifications and embraced in the claims. *Plummer v. Sargent*, 120 U. S. 442. The accused structure is an electric lamp bulb, the interior surface of which is "characterized by the presence of rounded as distinguished from sharp angular crevices," but it is not manufactured under the method embraced in the claims. It is clear from the undisputed testimony that the accused structure was manufactured under the method of Kennedy, hereinabove discussed, and that the chemical etching process employed had been in common use prior to Pipkin. This conclusion, although not conceded by the defendants, seems to be inescapable. It follows that the resulting structure cannot infringe the claims in suit. *Thompson v. Boisselier*, 114 U. S. 1, 9; *Comolite Corporation v. Davidovicz, et al., supra.*

The validity of the claims in suit has been sustained by the Circuit Court of Appeals for the Sixth Circuit, in the case of *General Electric Co. v. Save Sales Co., et al.*, 82 F. (2d) 100, and by the Circuit Court of Appeals for the Second Circuit, in the case of *General Electric Co. v. Wabash Appliance Corp. et al.*, 93 F. (2d) 671. These decisions, however, appear to be predicated upon narrow interpretations of the teachings of the prior art, with which this Court cannot agree. We doubt that the patent would survive if litigated in the Second Circuit today. This is indicated by the opinion of Judge Hand in the case of *Picard v. United Aircraft Corporation*, 128 F. (2d) 632, 636, in which he stated: "We cannot, moreover, ignore the fact that the Supreme Court, whose word is final, has for a decade or

more shown an increasing disposition to raise the standard of originality necessary for a patent. In this we recognize 'a pronounced new doctrinal trend' which it is our 'duty, cautiously to be sure, to follow not to resist.' "

The Findings of Fact and Conclusions of Law required by Rule 52 of the Rules of Civil Procedure have been prepared and filed by the Court.

FINDINGS OF FACT AND CONCLUSIONS OF LAW.

This is a suit for the infringement of Patent No. 1,687,510, issued on the application of Marvin Pipkin, who, prior to the issuance thereof, assigned all right, title and interest therein to the plaintiff. The patent covers an article of manufacture therein identified as an "Electric Lamp Bulb." This suit is directed to a similar article of which the defendant Jewel Incandescent Lamp Company is the manufacturer, and the defendant Nulite Electric Company is the distributor. The defendants deny infringement and challenge the validity of the patent.

Findings of Fact.

I.

The plaintiff, General Electric Company, is and was the owner of Patent No. 1,687,510, issued on the application of Marvin Pipkin on October 16, 1928. The claims of the said patent are directed to a manufacture therein identified as an "Electric Light Bulb". The defendant, Jewel Incandescent Lamp Company, is and was the manufacturer of incandescent lamps; the defendant Nulite Electric Company, a subsidiary, is and was the exclusive distributor of the said lamps. It is alleged by the plaintiff, but denied by the defendants, that these lamps infringe the claims of the patent in suit.

II.

The purported invention is defined in claim 1, which is typical, as follows: "*A glass electric lamp bulb having its interior surface frosted by etching* so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent. of that of said lamp with a clear bulb, *said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices* to such an extent that the strength to resist breakage by impact is greater than twenty per cent. of that of a clear bulb." When the allowed claims are read and interpreted in the light of the rejected claims and the prior art, it is evident that the invention of the patent, measured by the claims, is restricted to a glass bulb possessing an interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices." The allowed claims, although purportedly directed to an improvement in an article of manufacture, to wit, the interior mat surface, are so drafted as to necessarily embrace the chemical etching process by which the defined result is produced.

III.

The claims in suit are anticipated by the prior art, as exemplified in the following publications: Reinitzer, Contributions to the Knowledge of Glass Etching, Die Glashutte, published in 1887; Tillotson, On the Relation Between the Physical Properties and Chemical Composition of Glass Etch Figures, The Journal of Industrial and Engineering Chemistry, published in 1917; and, other papers cited in the memorandum filed herewith. The claims in suit are anticipated by the prior art, as exemplified in the Kennedy Patent (No. 733,972), the Wood Patent (No. 1,240,398), and the Correll Patent (British—No. 166,133). The disclosures of the cited publications and patents are fully discussed in the memorandum filed herewith.

IV.

It clearly appears from the disclosures of the prior art that the defined improvement, to wit, the interior mat surface "characterized by the presence of rounded as distinguished from sharp angular crevices" is the unavoidable result of a chemical etching process which had been in common use in the glass industry for many years prior to the present invention. It is obvious that there was nothing new in either the interior mat surface defined in the claims, or the process identified therein as the method of producing it. The advance over the prior art, if any, was in reality nothing more than the application of the chemical etching process to another article of hollow glassware, the bulb of an incandescent lamp, a course plainly indicated by the teachings of the prior art.

V.

The adaptation of the chemical etching process to a new article of manufacture in the art in which it had been well known and in common use required nothing more than the expected skill of the art.

VI.

The claims in suit are invalid because of anticipation by and lack of invention over the prior art.

VII.

The claims in suit fail to meet the requirements of the statute, R. S. 4888, 35 U. S. C. A. 33. The claims are vague and indefinite, and are, therefore, under the statute, void.

VIII.

There was nothing which distinguished the mat surface defined by Pipkin from the mat surface described by those who preceded him except the functions ascribed to it and the particular article of manufacture, to wit, diffusion of

light and resistance to breakage. The novelty of the invention, if any, lay, not in the structural elements, but in their function. The claims in suit are, therefore, void.

IX.

The accused structure does not infringe the claims in suit. It is apparent from the disclosures of the references hereinbefore cited, that the structural elements of the accused article, and particularly the improvement therein, substantially conform to similar structural elements of the prior art. It is equally apparent that the method of producing the mat surface of the accused structure had been well known and in common use long prior to the present invention.

CONCLUSIONS OF LAW.

I.

The claims of the patent in suit are void for the reasons hereinabove stated.

II.

The claims of the patent in suit are not infringed by the incandescent lamp manufactured and distributed by the defendants.

III.

Judgment in favor of the defendants and against the plaintiff may be entered.

NOTE: The Findings of Fact and Conclusions of Law are discussed in a separate memorandum filed herewith.

FINAL JUDGMENT.

This cause having come on to be heard upon the pleadings, proceedings and proofs herein, in behalf of both parties, and counsel for the respective parties having been heard and the cause having been considered by the Court, it is hereby

ORDERED, ADJUDGED and DECREED—

1. That the complaint herein be and it hereby is dismissed.

2. That the defendants recover from plaintiff for their costs sustained in the case, to be taxed by the Clerk; and that defendants have judgment therefor against plaintiff.

(Signed) WILLIAM F. SMITH.

Dated: Newark, N. J.,

January 7th, 1943.

The foregoing judgment is approved as to form:

/s/ HOWSON & HOWSON,
Solicitors for Plaintiff.

/s/ ALEXANDER C. NEAVE,
Counsel for Plaintiff.

/s/ KESSLER & KESSLER,
Solicitors for Defendants.

/s/ SAMUEL E. DARBY, JR.,
Counsel for Defendants.

[fol. 349] IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT, OCTOBER TERM, 1943

No. 8331

GENERAL ELECTRIC COMPANY, Appellant,

vs.

JEWEL INCANDESCENT LAMP COMPANY, et al.

And afterwards, to-wit, the 18th day of November, 1943, come the parties aforesaid by their counsel aforesaid, and this case being called for argument sur pleadings and briefs, before the Honorable John Biggs, Jr., Honorable Albert B. Maris and Honorable Charles Alvin Jones, Circuit Judges, and the Court not being fully advised in the premises, takes further time for the consideration thereof,

And afterwards, to wit, on the 22d day of December, 1944, come the parties aforesaid by their counsel aforesaid, and the Court, now being fully advised in the premises, renders the following decision:—

[fol. 350] UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

No. 8331

GENERAL ELECTRIC COMPANY, Plaintiff-Appellant,

v.

JEWEL INCANDESCENT LAMP COMPANY, et al., Defendants-Appellees

APPEAL FROM A JUDGMENT OF THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF NEW JERSEY

Before Biggs, Maris and Jones, Circuit Judges.

OPINION OF THE COURT—Filed December 22, 1944

By BIGGS, Circuit Judge:

This is an appeal from a judgment dismissing a complaint alleging infringement of a patent, No. 1,687,510, issued to Marvin Pipkin on August 16, 1928, on an application filed June 29, 1925, for an "Electric-Lamp Bulb". See

47 F. Supp. 818.[1] The patent has two claims and both are [fol. 351] in issue.[2] Pipkin's specification states that the the object of his invention "* * * is to produce an inside frosted glass [electric light] bulb which will be much stronger than those heretofore produced." He discloses a process for obtaining this result by subjecting the interior of the bulb, already etched by hydrofluoric acid, to a strengthening treatment. This consists of treating the interior surface of the bulb with hydrofluoric acid for a second time, the solution then employed being weaker. That the bulb, rendered very fragile by its first treatment with hydrofluoric acid, is greatly strengthened by the second, is not denied. Subjecting glass, already frosted, whether by sand blast or by acid, to a treatment of hydrofluoric acid is old in the art. This is conceded by the plaintiff.

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[1] The patent was held to be valid and infringed by the Circuit Court of Appeals for the Sixth Circuit in General Electric Co. v. Save, 82 F. 2d 100, and by the Circuit Court of Appeals for the Second Circuit in General Electric Co. v. Wabash, 93 F. 2d 671, certiorari denied 303 U. S. 641, rehearing denied *ibid.* p. 667. See also the concurring opinions in Fuso Electric Works v. Canadian General Electric Company, Limited, in the Supreme Court of Canada, 1940, 2 DLR 1, S. C. R. at p. 371 and p. 381, delivered in the suit on the Canadian patent based on Pipkin's disclosures. See also the decision of the High Court of Justice in the case of The British Thomson-Houston Co., Ld. v. Tungstalite, Ld., Reports of Patents, Design and Trade Mark Cases, Vol. LVII, No. 10, November 20th, 1940, on a process patent issued to Thomson-Houston Co. Ld.

[2] Claim 1 is as follows: "A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than twenty per cent of that of the clear bulb."

The second claim is the same as the first except that the words "forty-five per cent" are substituted in lieu of the words "twenty per cent" as the measure of the bulb's strength to resist breakage by impact.

The concession is necessary in view of prior publications on the subject.[3] In the prior art hydrofluoric acid was put upon the glass, already etched or frosted, for the purpose of giving it a fine "satin" finish or "matt". But nothing in the prior art suggested Pipkin's paradox that by destroying more glass the bulb would be strengthened.[4]

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[3] See Sprechsaal, No. 48; The Etching of Hollow Glass, Sprechsaal, No. 49, published in 1907; Sprechsaal, Nos. 21 and 22, published in 1906; Reinitzer, Contributions to the Knowledge of Glass Etching, Die Glashutte, published in 1887; Tillotson, On the Relation Between the Physical Properties and Chemical Composition of Glass Etch Figures, The Journal of Industrial and Engineering Chemistry, published in 1917; Present Day Manufacture Working Up and Ornamentation of Finer Hollow Glass (Hohlbaum, 1910). See also the parent patent to Wood, No. 1,240,398, describing a similar two step etching process. The patent also states, "Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing the very marked loss in the efficieny of the lamp, which results from frosting the bulbs in the usual manner," and the Correll British Patent No. 166,133. See in particular Sprechsaal, No. 40 (1907), which describes a process which consists first in frosting or etching a hollow glass article and, as a second step, subjecting the etched surface to the action of an alkaline fluoride.

[4] Pipkin's specification states that the "probable" explanation for this phenomenon is that following the first treatment the surface of the glass is covered by depressions or pits having sharply defined angles, while following the second or strengthening treatment these depressions or pits become more or less rounded.

One of the plaintiff's expert witnesses explained the effect of the second treatment as follows, "Because in the instance where we have sharp angular crevices on the inside surface and the bulb is subjected to impact on its outer surface, the inner surface tends to be extended and therefore it is put into tension and the sharp angular crevices are the starting point for cracks, whereas * * * [when] the crevice has been rounded out the impact against [the] bulb * * * is such that the testing effort is spread over a very much larger area and the bulb is almost as strong as it was before frosting."

[fol. 352] Actually, the second treatment with the acid rounds the sharply angular crevices created in the glass by the first etching. If the bulb is then subjected to a blow, it will not fracture as readily for its strength will have been greatly increased. This was the gist of Pipkin's disclosure and it was a very important one for the electric light bulb industry. We must now determine whether the District Court erred in holding the claims invalid.[5]

Pipkin's specification would be appropriate to support process claims. The claims of the patent purport to appropriate a "product." They are very close, however, to being "process" claims. See Red River Refining Co. v. Sun Oil Co., 29 F. Supp. 636, 641, affirmed by this court, 112 F. 2d 575. Each claim appropriates "A glass electric lamp bulb having its interior surface *frosted by etching so that* * * *" it will be "characterized by the presence of rounded as distinguished from sharp angular crevices *to such an extent* * * *."[6] that the bulb will have the specified degrees of light diffusion and of tensile strength. The italicized portions of the claims can be treated as describing functional characteristics but the claims are product claims and must be so construed. Even if we were to treat the claims as appropriating a process they do not embrace the two steps disclosed and described in Pipkin's specification and it is [fol. 353] impossible to read the second step into the claims from the specification.

As product claims there is an insuperable bar to their validity. They appropriate an old product. If the claims of the patent were process claims and appropriated the two step process of Pipkin's specifications they might be held valid under the principle enunciated in Ansonia Brass Co. v. Electric Supply Co., 144 U. S. 11, 18. In the cited case Mr. Justice Brown stated, "* * * if an old device or process be put to a new use which is not analogous to the old one, and the adaptation of such process to the new use is of such a character as to require the exercise of inventive

[5] It is not necessary to discuss the contentions of the defendants that Pipkin did not make the oath required by law to his claims and departed abruptly in his continuation application from the disclosures of his original application, or that the claims are too vague and functional to comply with the requirements of R. S. Section 4888.

[6] Emphasis supplied.

skill to produce it, such new use will not be denied the merit of patentability." But it is obvious that the principle quoted cannot be extended for the benefit of a patentee who claims nothing more than a product old in the art. Nor is the plaintiff in the instant case aided by our decision in Gilbert Spruance Co., v. Ellis-Foster Co., 114 F. (2nd) 771, 773. In the patent under consideration in the Gilbert Spruance case Weber achieved a new product and claimed it. In the light of the prior art the claims of Pipkin's patent were rightly held to be invalid.

The judgment is affirmed.

A true Copy:

Teste:

——— ———, Clerk of the United States Circuit Court of Appeals for the Third Circuit.

[fol. 354] IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT, OCTOBER TERM, 1943

No. 8331

GENERAL ELECTRIC COMPANY, Appellant,

vs.

JEWEL INCANDESCENT LAMP COMPANY, et al., Appellees

Present: Biggs, Maris and Jones, Circuit Judges

On Appeal from the District Court of the United States for the District of New Jersey

This cause came on to be heard on the transcript of record from the District Court of the United States for the District of New Jersey, and was argued by counsel.

On consideration whereof, it is now here ordered and adjudged by this Court that the judgment of the said District Court in this case be, and the same is hereby affirmed, with costs.

By the Court, John Biggs, Jr., Circuit Judge.

December 22, 1944.

Endorsements: Order Affirming Judgment. Received and Filed Dec. 22, 1944. Wm. P. Rowland, Clerk.

[fol. 355] UNITED STATES OF AMERICA,
Eastern District of Pennsylvania,
Third Judicial Circuit, Sct.:

I, William P. Rowland, Clerk of the United States Circuit Court of Appeals for the Third Circuit, do hereby certify the foregoing to be a true and faithful copy of the original Joint Appendix to Briefs, as constituting the portions of the record before this Court at argument; and proceedings in this Court, in the case of General Electric Company, Appellant, vs. Jewel Incandescent Lamp Company, et al., No. 8331, on file, and now remaining among the records of the said Court, in my office.

In Testimony Whereof, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this 12th day of January in the year of our Lord one thousand nine hundred and forty-five and of the Independence of the United States the one hundred and sixty-ninth.

Wm. P. Rowland, Clerk of the U. S. Circuit Court of Appeals, Third Circuit. (Seal.)

[fol. 356] SUPREME COURT OF THE UNITED STATES

ORDER ALLOWING CERTIORARI—Filed April 9, 1945

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Third Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.